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MACHINE DESIGN

as it affects ENGINEERING • PRODUCTION • SALES

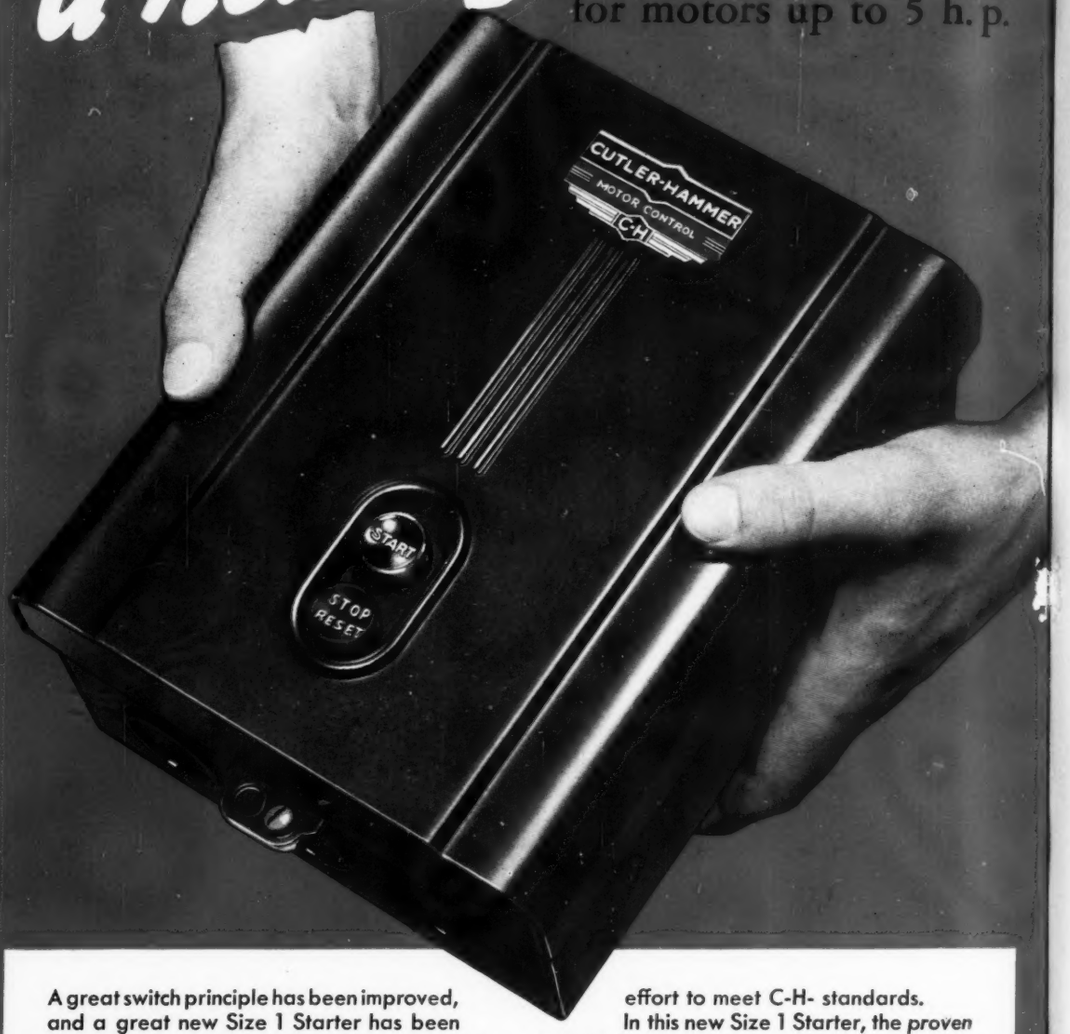
PARTS MATERIALS METHODS FINISHES

OF MACHINES OF EVERY SIZE AND TYPE

Cutler-Hammer Scores Again

A New Size 1 Starter

for motors up to 5 h.p.

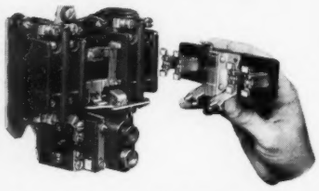


A great switch principle has been improved, and a great new Size 1 Starter has been brought out by Cutler-Hammer for the control and protection of single phase motors and polyphase squirrel cage motors up to 5 h.p.

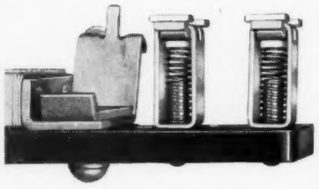
The basic design of this new starter is the design that has been pronounced repeatedly an outstanding example of masterful engineering. It has proven its correctness during 10 years of sales leadership . . . 10 years during which time it has withstood, successfully, repeated redesigns, by others, in an effort to meet C-H- standards.

In this new Size 1 Starter, the *proven* C-H design has not been changed . . . simply *refined* . . . and *improved* . . . to set still higher standards of performance. Seasoned and practical men recognize the worth of these refinements at once. Make sure you see this new starter immediately. Cutler-Hammer Representatives will be glad to demonstrate its advantages to you. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers,* 1310 St. Paul Ave., Milwaukee, Wis.

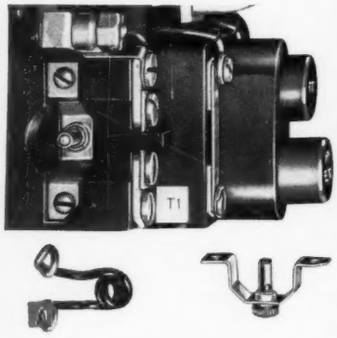
Some of the outstanding features of the New C-H NEMA Size 1 Starter



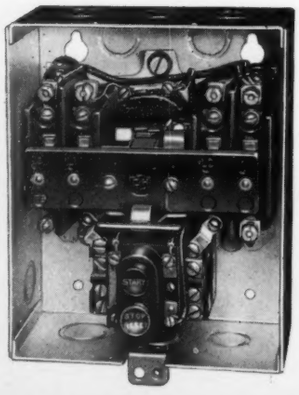
Vertical Dust-Safe Contacts Dust can't settle on vertical contacts. Vertical contacts mean better motor control. C-H vertical, dust-safe contacts are out in the open, cool, accessible, *safe.*



The pure "fine" silver contacts have been made much heavier, to establish *new* records for trouble-free performance under the most severe service. Lava insulators protect contact springs against even minor heat transmission, thus insuring full contact pressure at all times . . . an instantly accepted feature of good engineering which greatly extends the life of these working parts. Both contact springs and contact supports are now made of stainless steel . . . a feature widely accepted, but appreciated most where corrosive atmosphere is a problem.



The famed C-H "Drop of Solder" overload relay has been *further refined.* New *enclosed* heater coil construction . . . and new solder-alloy assembly easily and quickly removed for inspection. When an overload occurs, you don't have to guess why the motor has stopped. The red button pops forward, telling you at once. Overload relay is free-tripping.



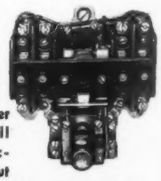
The use of new Densheath internal wiring makes the Size 1 Starter exceptionally workmanlike in appearance. From the handsome cover, streamlined and simplified in the best modern design, to the beautifully finished light interior, advanced design is used throughout. Case has solid back. Mechanism is rubber mounted on a dead-back panel.

CUTLER-HAMMER
MOTOR CONTROL
C-H

THE NEW C-H 9586 NEMA SIZE 1

Price $16.00*

***With Start and Stop buttons in case as illustrated, price $18.00**



The new C-H Starter is available in all standard constructions, with or without pushbuttons in case, with transfer switch, in combination starter, and in skeleton construction for built-in application.

MACHINE DESIGN

THE PROFESSIONAL JOURNAL OF CHIEF ENGINEERS AND DESIGNERS

Volume 12 — FEBRUARY 1940 — Number 2

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NEW DEPARTURE

THE FORGED STEEL BEARING

MACHINE DESIGN

By L. D. Tyson
Chief Engineer
Foster Machine Co.

Superfinishing Requires Complex Motions

SUCCESSFUL and practical superfinishing depends mostly on the manner in which abrasives are applied to the surface of the work. A proper combination of the following are essential: Work motions, work speed, abrasive motions, abrasive speeds, grit, grain, bond of abrasives, pressure of the abrasive to the work surface, lubricant, and also a proper preparation of the surface previous to the superfinishing operation. Of these, the subject of motions is of most concern to the designer.

In a single purpose machine, built for finishing a specific part, the proper combination of motions, speeds, etc. may be built into the machine without any necessity for providing any great degree of variation or flexibility. However, in a general purpose machine, designed to take a variety of parts, it is essential to

Fig. 1—This machine with 12 work heads is capable of finishing external cylindrical surfaces of varying lengths and diameters within range of the machine

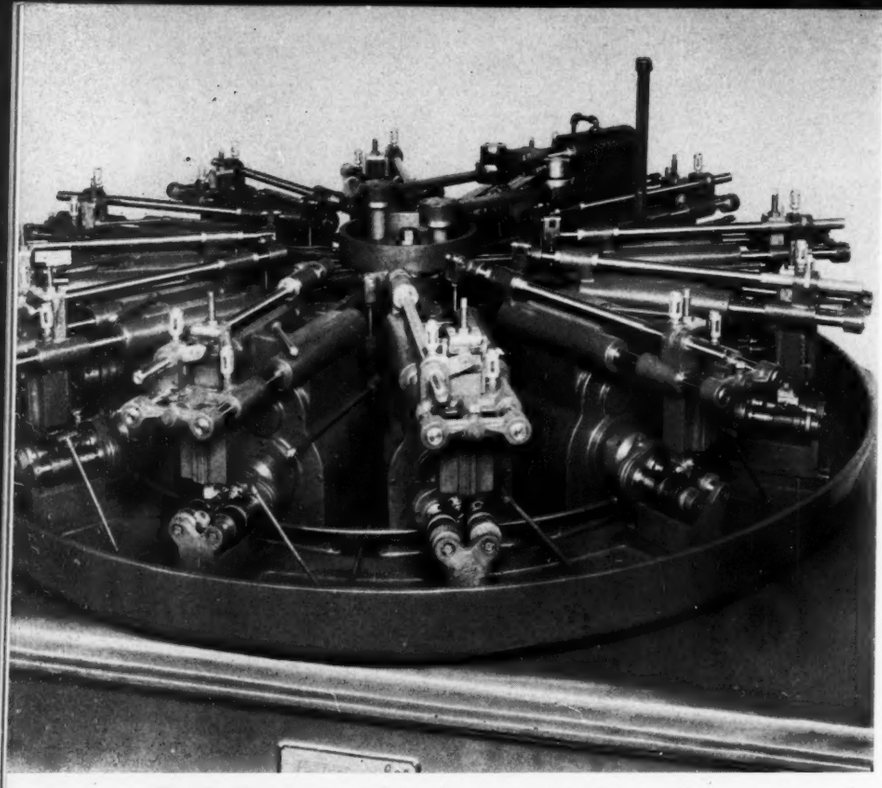


Fig. 2—Cover removed to show eccentric drive and connecting rods. Abrasive lifting device and crankshaft stabilizer are also shown

provide for readily obtaining whatever combinations may be required.

This article will deal with means for providing motions in various combinations, particularly in the machine shown in *Fig.* 1. It is a general purpose machine for high production, recently developed by the Foster Machine Co. for superfinishing external cylindrical surfaces on shafts, pins, pistons, or other parts within the range of three or four inches in diameter and up to six inches in length.

Within the base are mounted the drive motors, pump, and lubricant tank. A revolving carrier is also mounted on the base, which in turn carries twelve work driving heads, and twelve abrasive heads with operating and retracting mechanisms. The machine is of the continuous rotary type, as the carrier is continuously revolved by means of a worm and worm gear.

Relatively short and fast reciproca-

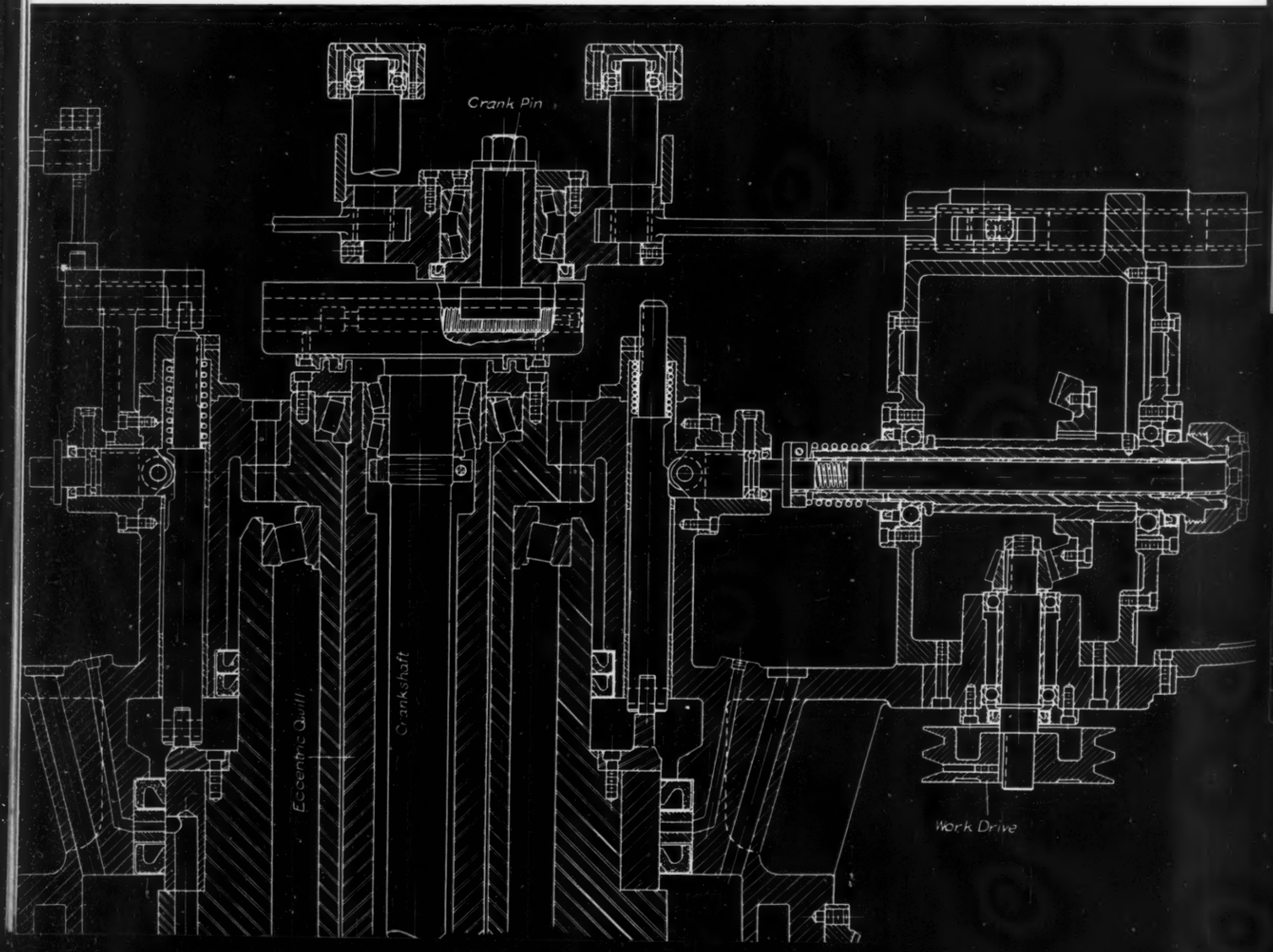


Fig. 3—Varying complementary motions are transmitted to connecting rods through eccentric quill and crankshaft. Crankshaft motion is adjustable at crankpin. Work spindle at right is driven through bevel gear and pinion to rotate workpiece held in collet

tion is transmitted to the abrasive or stone by driving the eccentric sleeve or quill, located vertically in the center of the machine as seen in *Fig.* 3. To the lower end of the sleeve is attached a drive pulley (not shown) and inside the eccentric sleeve is carried a crankshaft which also has a drive pulley at the lower end. The upper end of the crankshaft has a flange on which is mounted a crankpin. Each of the twelve abrasive heads are connected to this crankpin by means of connecting rods and a connecting rod hub. Thus revolving the sleeve, without any revolutions of the crankshaft, will produce the short reciprocations of the abrasives at such speed as the sleeve may be driven.

Stroke Is Adjustable

Reciprocation, or the second motion, is imparted to the abrasives by revolving the crankshaft independently of the sleeve. The crankpin, mounted in the head of the crankshaft, is adjustable from zero to maximum stroke so the desired amount of stroke may be obtained to cover properly the length of the work. This second motion is usually slower and longer than the first motion. *Fig.* 2, with the top cover removed, shows the eccentric quill and crankshaft arrangement for imparting these reciprocating motions. Arrangement of the work heads around the crank makes possible this compact design.

The connecting rod hub is stabilized by a pair of auxiliary rods, *Fig.* 4. They are mounted in a plane above the main connecting rods which in turn are provided with a guide rod, thus insuring a uniform motion to all heads. Abrasive heads are each mounted on two sliding rods which have bearings or guides in the several work heads, *Fig.* 5. Work pieces are revolved about their own axes by the spindles which are driven through bevel gears, pinions and pulleys on the lower ends of the pinion shafts, *Fig.* 2. These pulleys are in a circular position around the center of the carrier, and a continuous belt passes over the pulleys, except at the loading side of the machine where the belt leaves the pulleys and goes over a common drive pulley, mounted on a shaft in that side of the base. Hence all spindles are driven by this belt except one or two which are passing through the loading portion of the cycle,

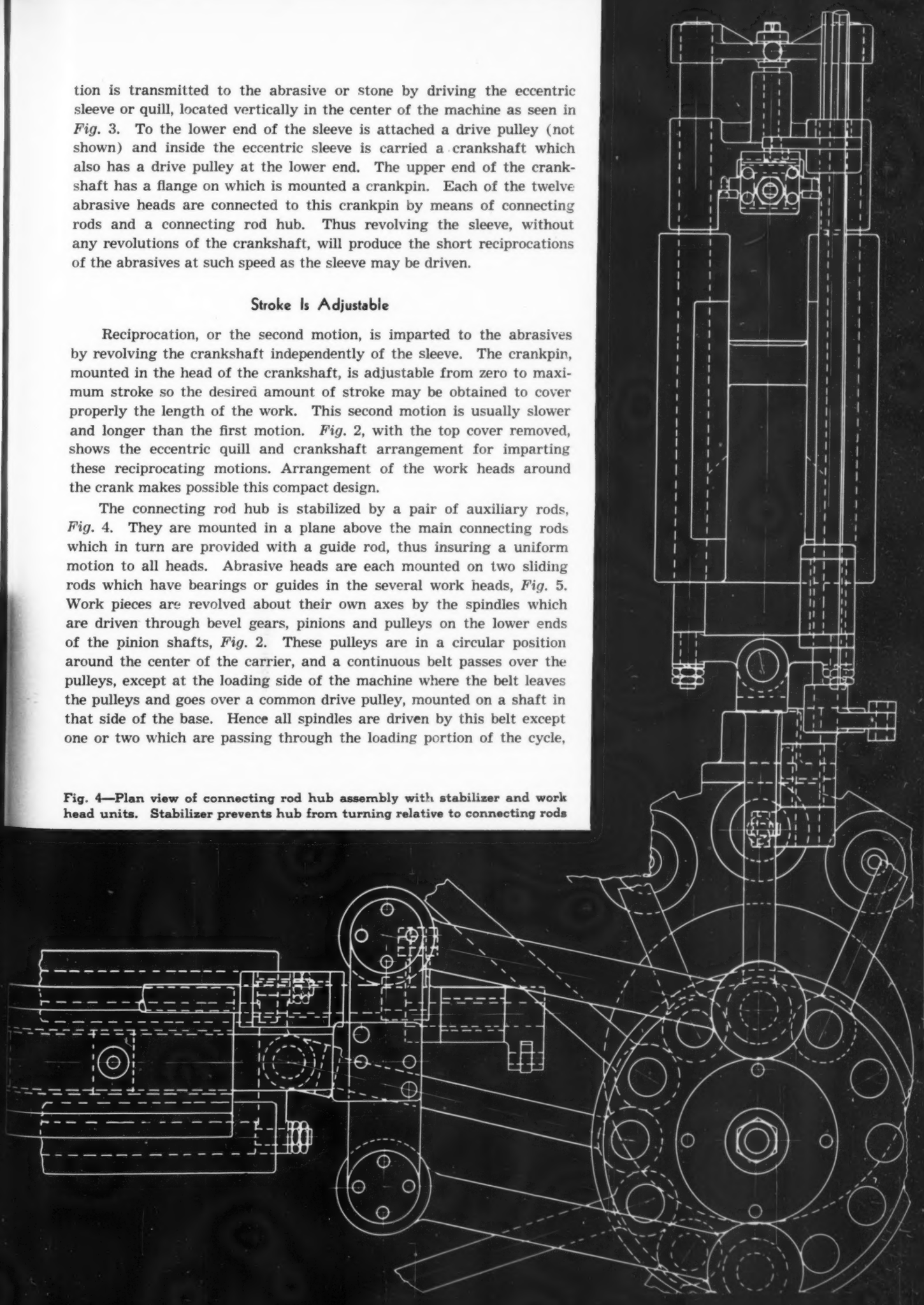


Fig. 4—Plan view of connecting rod hub assembly with stabilizer and work head units. Stabilizer prevents hub from turning relative to connecting rods

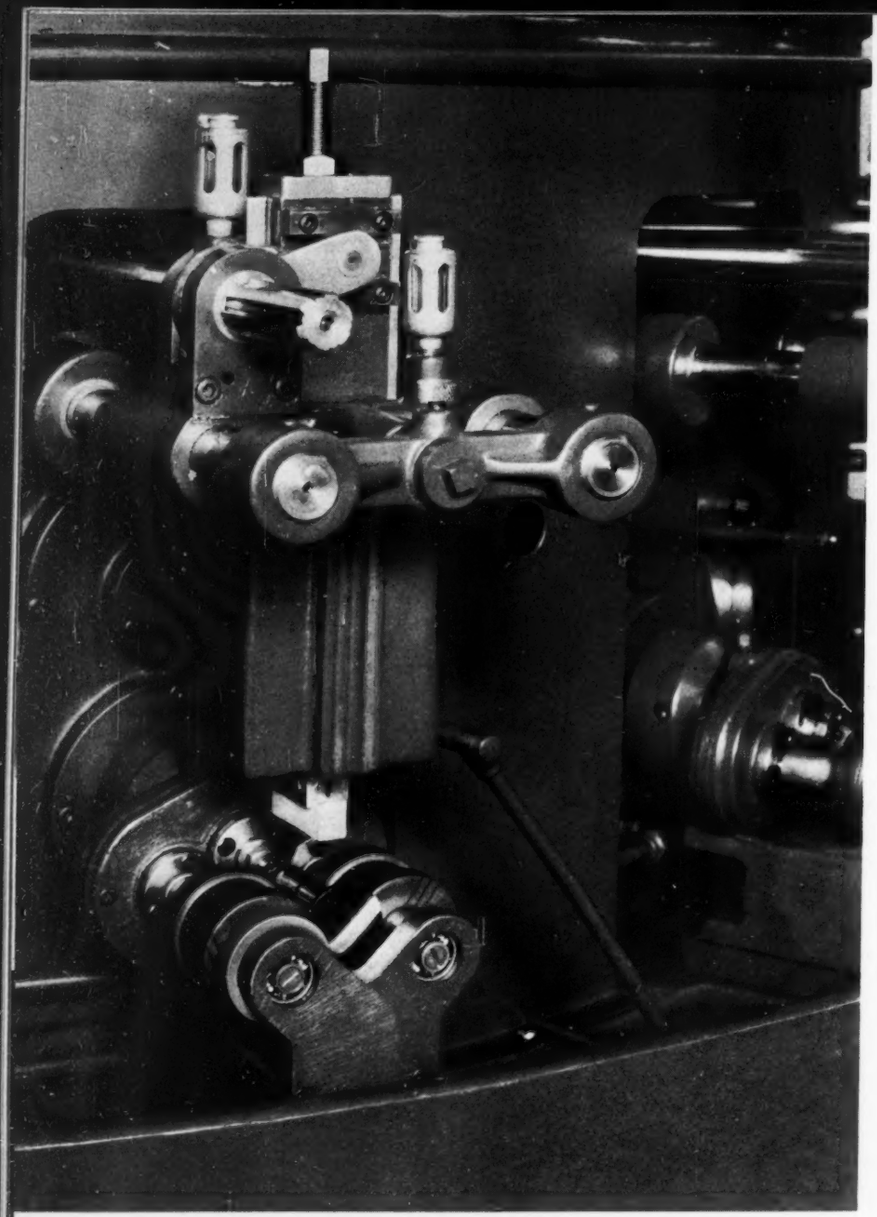
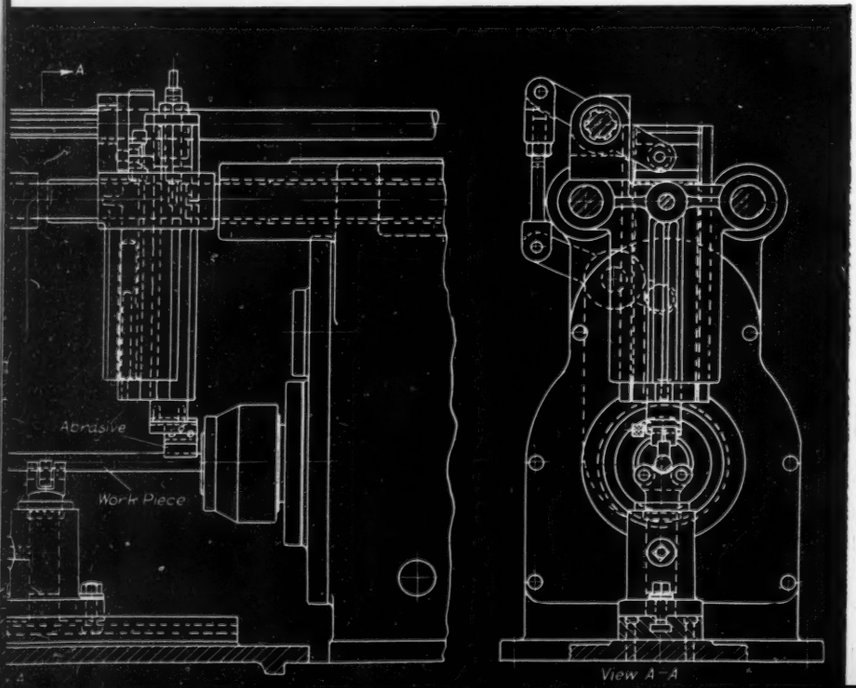


Fig. 5—Closeup of work head with abrasive lifted at finish of operations. Workpiece holding arrangement consists of collet and roller type steadyrest. Stone lifting device and pressure adjustment are seen at top

Fig. 6—Work head with workpiece and stone in position. Slides for imparting longitudinal motions and stone lifting device are shown



during which portion a brake is effective to prevent rotation of the work spindles, facilitating leading operations.

Each head or work station is provided with a vertical push rod, having at its lower end a roller which rides on a stationary cam track mounted on the main base. The cam track has an elevated portion corresponding with the loading portion of the machine.

As the head approaches the loading station, each push rod elevates the stone holder slide through a lever and link mechanism so that the stone is held out of contact with the work during the unloading and reloading period. The push rod also operates a collet mechanism, thus holding the collet open to permit unloading and reloading of each station in succession. Stone is lifted by the toggle arrangement in the drawing, *Fig.* 6. Collet release, *Fig.* 3, is operated by spring-return roller riding down recess in shaft to effect cam action.

Springs Apply Pressure

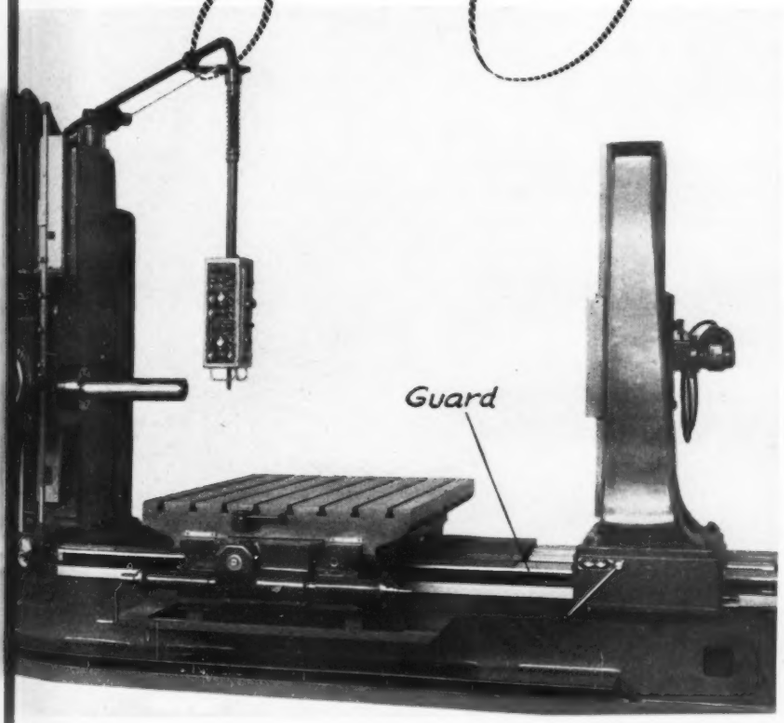
Pressure is applied to the abrasive stones by means of springs mounted in the abrasive slides. The springs are backed up by adjustable screws to provide whatever pressure is required. This pressure is dependent on several factors that vary with the different types of work.

Fig. 6 shows a piece of work, the stem of which is to be finished. It is held in a collet mounted in the spindle of the work head and is further supported. In this way different types and designs of chucking and driving mechanism may be supplied to accommodate the varying characteristics of the work piece.

Thus it will be apparent that a variety of combinations of speeds and motions are available. The abrasives may have only the relatively short and fast reciprocation imparted through the means of the eccentric sleeve, or only the relatively longer and slower reciprocation imparted through the means of the crankshaft proper, or a combination of both motions may be used. By a further adjustment of pressure, selection of abrasive and lubricant, almost any desired results may be obtained, thereby making the machine adaptable to finishing almost any piece of work within its range.

Scanning the Field

FOR IDEAS

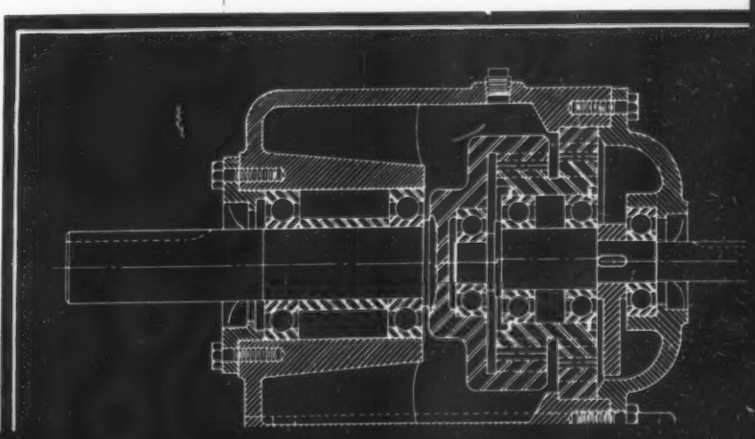


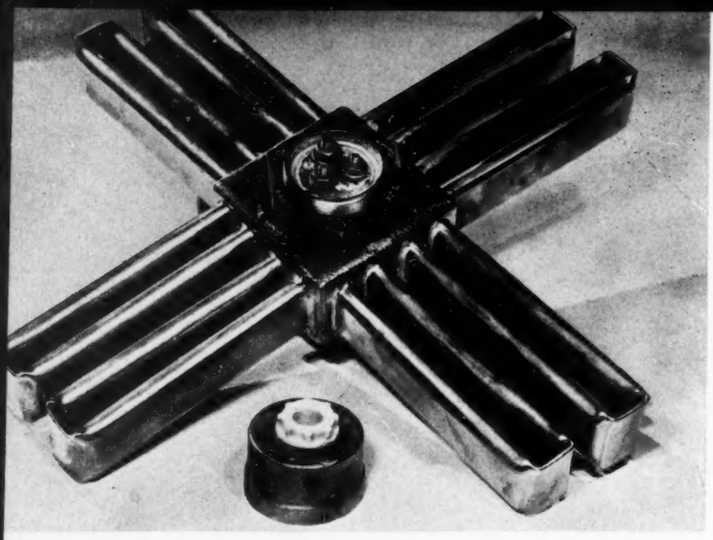
Suitable guards for machines, especially on finished ways, have always been a problem. If portable, often the operator forgets to replace them and the ways have no protection during setup time. Problems of this nature have been satisfactorily solved by the Lucas Machine Tool company by using permanent guards covering the entire length of the bed ways. Slots are cast in movable members through which the guards pass. In the horizontal boring, drilling and milling machine shown, the saddle and back rest base have such slots.

Guards are formed sheet channel with strip steel welded on channel sides for strength. Plates, bolted on the sides in saddle and back rest, act as both wipers and supports. Guards also aid in setup time by being convenient supports for platform and tools. Thus ways are permanently protected against falling objects. damage from abrasion caused by shoes, etc.

High ratio speed reductions are developed by the compact Brad-Foote Gyro reducer shown in the accompanying sectional drawing. A double spur or combination spur and internal gear; ball bearing mounted on drive shaft eccentric, meshes with a stationary internal gear. In mesh with the secondary gear is either a spur or internal gear which is solid and concentric with the output shaft. Eccentric drives initial spur around pitch line of the stationary internal gear. Since initial spur and secondary gear are solid, the speed of the latter is controlled by ratio between initial spur and stationary gear.

To obtain large ratios, a small difference in number of teeth between spur gear and internal gear is used. This makes the pitch line of the spur almost conform to that of the internal gear. Thus a large number of teeth are engaged, increasing the load-carrying factor. Efficiencies of this design range between 70 and 90 per cent with reduction ratios from 20:1 to 7500:1





Pivoted flights convey materials without agitation in this elevator-conveyor designed by the Jeffrey Manufacturing company. This unit provides a low-cost method of handling all kinds of granular materials such as cereals, coal, sawdust, soap chips, soy bean meal, chemicals, etc.

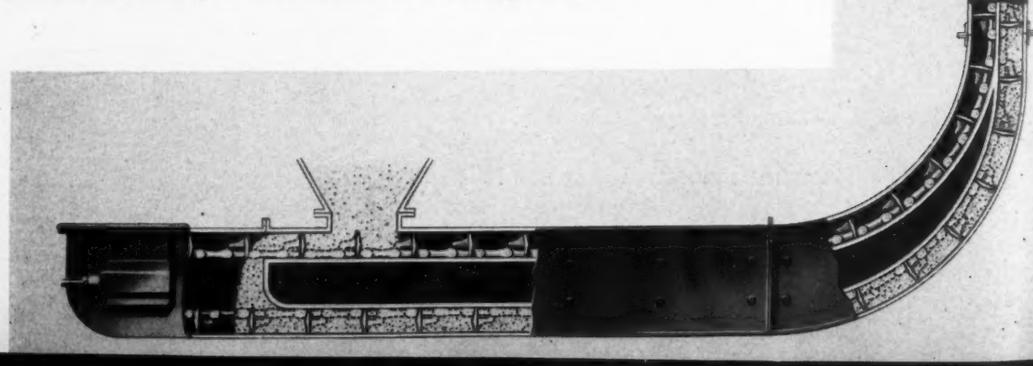
Simple in design and construction, it consists of a steel casing through which solid pivoted flights spaced at intervals on a single strand of chain, move the material horizontally or vertically in a solid mass or with partial load.

At the discharge point is seen how the flights are discharged of their load by means of a tripper. Since each flight may carry a full or a partial load, depending on rate of feed, the design is self emptying after feeding stops.

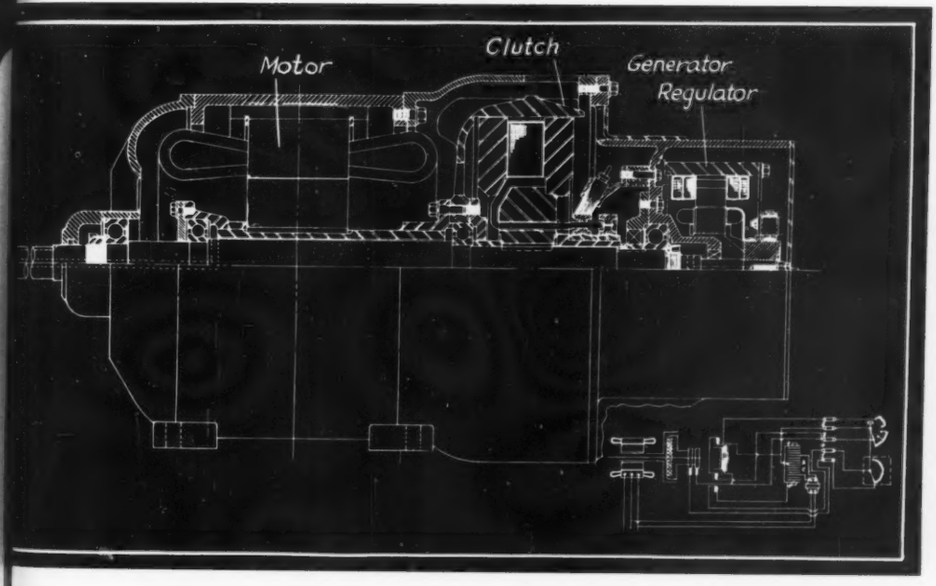
Because of little agitation, breakage and degradation are practically eliminated. Little installation space is required and is another feature of this type of design

Leak-tight joints under conditions of repeated heating and cooling at 100 pounds per square inch pressure are produced in this heating element by the Harold E. Trent Co. Copper or steel alloy tubes with electrical unit assembled inside are brazed with Easy-Flo brazing alloy and torch. Thin section of tubing used makes it desirable to keep the heat for making the joints as low as possible. Free flowing and rapid penetration of alloy make a fast and economical method producing finished joints which are smooth and even requiring no finishing work

Ivory enameled plastics now make available ivory or other finishes on a lower cost plastic base. The radio shown is ivory enameled by this process which has been developed by Stewart-Warner engineers. Case is phenol formaldehyde, sprayed with enamel and baked in a temperature of 270 degrees Fahr. This new method may have wide applications to plastic molded parts where it is not necessary to have solid color through section



Shims facilitate assembly and maintenance where close-limit assemblies require hand fitting such as in the connecting rods for a homogenizing machine in the illustration at the right. Shim, manufactured by the Laminated Shim Co., is built up in .002 inch layers to allow fitting to this limit. Also, in service, the bearing may be refitted to take up play due to wear



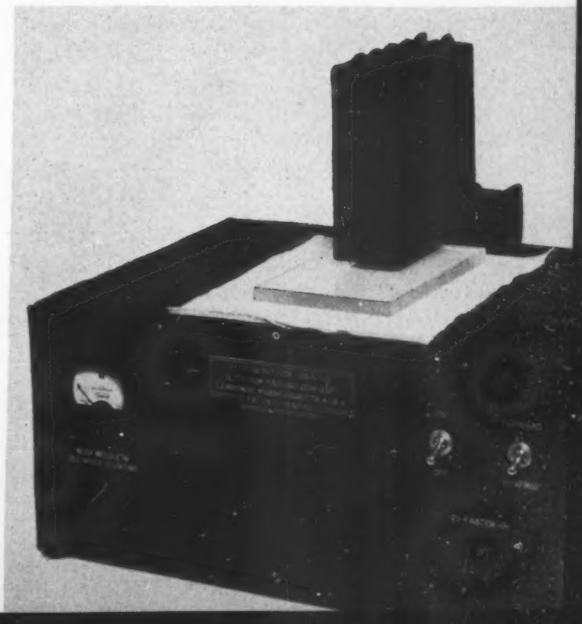
Phototube counts threads in cloth by utilizing a tiny beam of light less than .001 inch wide. Intermittent intensity of light as it passes over the threads sets up electronic impulses on phototube. Impulses are amplified to operate a magnetic counter. A carriage moves the unit three inches over the cloth in this instrument (below) developed by Sjoestroem Machine Co.

Travel of carriage is controlled by a geared head motor with variable speed. Time to move three inches varies from ½ to 1½ minute depending on fineness of cloth to be counted for threads

Magnetic clutch is built-in to provide adjustable speeds for the unit shown above in cross section and with schematic electrical diagram. Developed by the Louis Allis Co., ccmpact design is obtained chiefly by the shape of the magnetic poles on the variable speed clutch member. These poles create a very high flux density across the air gap at the pole tips requiring minimum excitation.

Slip of clutch, speed reduction, is dependent on the excitation current flcwing through the clutch coil. As this current, obtained from a generator regulator, is reduced through an external rheostat, the slip increases to hold the torque constant.

Efficiency of clutch at rated speed and output is 95 per cent. Slip at this speed with maximum excitation is about 30 to 40 revolutions per minute. Besides speed control and applications, magnetic clutches are especially useful for shock loads, absorbing them electrically instead of mechanically



Designing Flat Springs T

Part II

By A. M. Wahl
Westinghouse Electric & Mfg. Co.

BEHAVIOR of simple leaf springs and flat springs under combined axial and lateral loadings is vitally important in many designs. Methods for calculating their stresses and sizes together with formulae and graphs for quickly estimating the proportions needed are discussed.

In *Fig.* 1 is shown a sketch of a simple leaf spring loaded by forces P at each end and supported by a

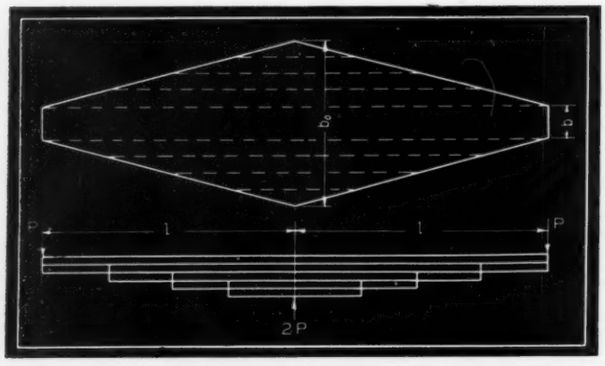


Fig. 1—Reduction of simple leaf spring to trapezoidal profile cantilever spring

force $2P$ at the bottom. Neglecting interleaf friction as a first approximation this spring may be calculated as a simple trapezoidal spring. If there are n_1 leaves of length $2l$ and width b_1 and if there is a total of n leaves, then from *Fig.* 1, $b = n_1 b_1$ and $b_0 = n b_1$. The ratio b/b_0 will be n_1/n and the curves of *Figs.* 2, 4 and 5 as discussed in Part I (M. D., Jan.) may still be used.

A type of spring loading which frequently occurs in practice is the cantilever spring with one end rigidly built in and the other end free to move laterally, but restrained from rotation; the deflection being of the type shown in *Fig.* 2. The spring may support a weight in the vertical direction which is represented by the axial force P. Such cases occur where a vibrating table is supported by springs of this type, the vibration being actuated by a crank arrangement. An example of an application of this type of spring is in a Fourdrinier paper machine. Vertical flat strips, known as shake springs, support the weight of the table, *Fig.* 5. These springs are subject to the loading conditions shown schematically in *Fig.* 2. If the axial load P is very small compared to the buckling load, the deflection and stress may easily be figured from ordinary beam theory. The resulting equations are

$$\delta = \frac{Q l^3}{12 E I} \quad \ldots\ldots (1)$$

$$S = \frac{3 \delta E h}{l^2} \quad \ldots\ldots (2)$$

In these, l = length of beam (*Fig.* 2), $I = bh^3/12$ = moment of inertia of section where b = width, h = thickness, δ = total deflection, S = nominal stress at built-in edge (stress concentration neglected). Where springs are subject to fatigue loading as mentioned previously, the stress S should be multipled by a stress concentration factor.

Correction Factors Required

Where the axial load P, *Fig.* 2, is not small compared to the buckling load, these equations no longer apply accurately. In such cases a more accurate analysis shows that the stress and deflection may be found by multiplying the results calculated from Equations 1 and 2 by factors C_1 and K_2 which depend

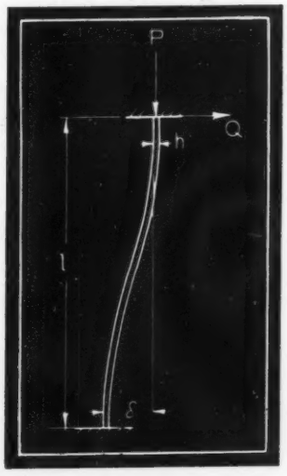


Fig. 2—Cantilever spring under combined axial and transverse loading

ngs To Fit the Job

on the ratio $P/P_{cr} = Pl^2/EI\pi^2$ where $P_{cr} = EI\pi^2/l^2$ is the Euler critical or buckling load. Thus:

$$C_1 = \frac{1}{1-\frac{P}{P_{cr}}} \quad \ldots\ldots (3)$$

$$K_2 = 1 - 0.178\frac{P}{P_{cr}} \quad \ldots\ldots (4)$$

$$\delta = C_1\frac{Q\,l^3}{12\,E\,I} \quad \ldots\ldots (5)$$

$$S = K_2\frac{3\,\delta\,E\,h}{l^2} \quad \ldots\ldots (6)$$

In *Figs.* 3 and 4 values of C_1 and K_2 are plotted against the ratio P/P_{cr}. An approximate method of calculating* the factor C_1 is as follows: Assume that under the action of loads P and Q the spring deflects into a cosine curve of the form:

$$y = \frac{\delta}{2}\left(1 - cos\frac{\pi x}{l}\right) \quad \ldots\ldots (7)$$

The potential energy stored in the beam is

$$V = \frac{E\,I}{2}\int_0^l \left(\frac{d^2y}{dx^2}\right)^2 dx = \frac{E\,I\,\pi^4\,\delta^2}{16\,l^3} \quad \ldots\ldots (8)$$

Assume that deflection δ increases a

* For a more exact method applied to the case of a simply supported beam see "Theory of Elastic Stability," p. 28, by Timoshenko, McGraw-Hill, 1936.

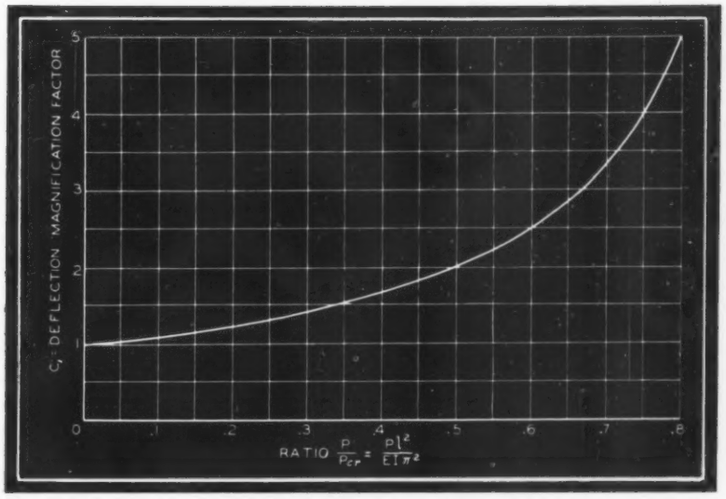
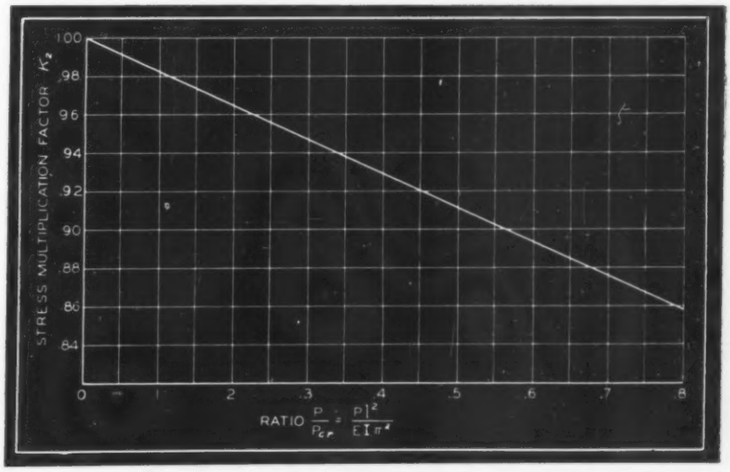


Fig. 3—Curve for calculating deflection of cantilever springs under combined lateral and axial loads. C_1 is plotted against P/P_{cr}

Fig. 4—Stress correction factor for cantilever springs under lateral and axial loads. K_2 is plotted against P/P_{cr}



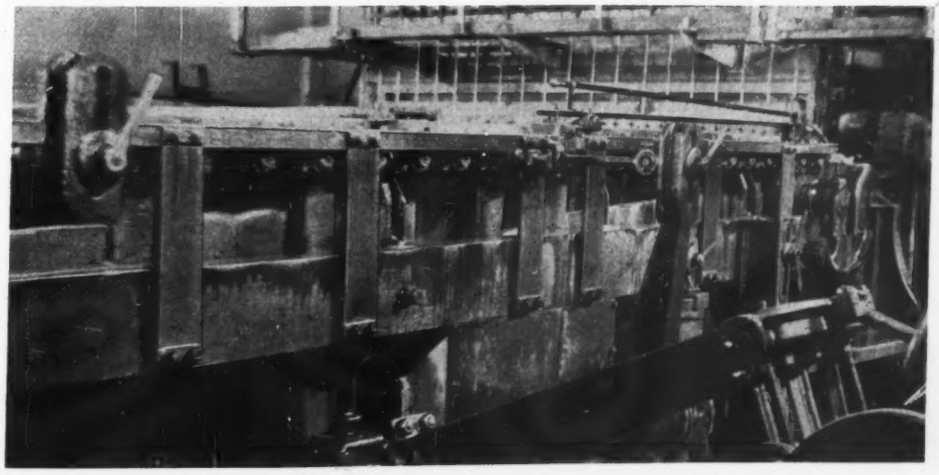


Fig. 5—Micarta shake springs installed on a paper making machine

small amount ($\Delta\delta$). From Equation 8 this changes the potential energy V by an amount $EI\pi^4\ 2\delta(\Delta\delta)/16l^3$ neglecting small quantities of higher order. The lateral force Q does the work $Q(\Delta\delta)$ and it may be shown that the vertical movement of the axial force P is approximately $\pi^2\delta(\Delta\delta)/8l$ which means that the work done is $P\pi^2\delta(\Delta\delta)/8l$. Equating the change in potential energy to the work done by the forces P and Q:

$$\delta = \frac{Q\,l^3}{12.2\,E\,I\left(1-\frac{P}{P_{cr}}\right)} = C_1\,\frac{Q\,l^3}{12.2\,E\,I} \qquad (9)$$

which is practically the same as Equation 5.

The maximum stress is equal to:

$$S = \frac{Q\,l}{2\,Z} + \frac{P\,\delta}{2\,Z} \qquad (10)$$

where Z is the section modulus.

Substituting the expression for Q given by Equation 5 in Equation 10, we obtain Equation 6.

The curve of *Fig.* 3 shows that where the axial load is half the critical buckling load, the factor $C_1 = 2$; i.e., we may expect twice as much deflection as would be expected if Equation 1 based on ordinary beam theory were used. For ratios P/P_{cr} equal to 0.5 or less, the curve of *Fig.* 4 indicates that the stress formula of Equation 2 is less than 10 per cent in error. In addition where δ is given (as is the case where a crank arrangement is used to actuate the spring) the stresses figured from Equation 2 are always somewhat higher than the actual stresses, i.e., on the safe side.

Stress Increases in Thin Spring

It should also be noted that where the spring is quite wide compared to its thickness, as it usually is, the calculated deflection as given by Equation 5 and the ratio P/P_{cr} should be multiplied by $(1-\nu^2)$ and the calculated stress as given by Equation 6 divided by $(1-\nu^2)$. This will mean about a 10 per cent increase in stress over that figured from Equation 6.

An interesting application of the use of large flat springs in design is shown schematically in *Fig.* 6 which represents a stack of plate springs supporting the frame of a large generator. The purpose of this arrangement is to absorb the periodic torque pulsations inherent in a single-phase type of machine without the transmission of objectionable vibration to the foundation. The mode of deflection of this type of spring is shown by the dashed line of *Fig.* 7. From beam theory the deflection per spring may be calculated as:

$$\delta = \frac{P\,l_2^2\,l_1}{2\,E\,I}\left(1+\frac{2\,l_2}{3\,l_1}\right) \qquad (11)$$

where l_2 and l_1 are the dimensions shown on *Fig.* 7 and P is the load at each end. For very wide springs in relation to the thickness this deflection should be multiplied by $(1-\nu^2)$ as explained previously. The maximum stress is given by

$$S = \frac{6\,P\,l_2}{b\,h^2} \qquad (12)$$

Springs of this type are normally subject to relatively low stresses. It is only under severe short circuit conditions (which occur infrequently) that the design stresses are reached.

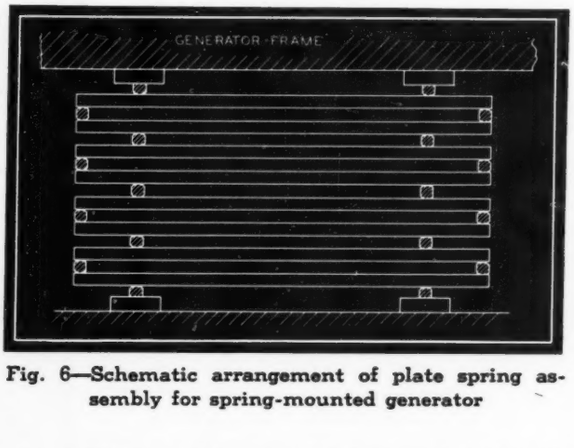


Fig. 6—Schematic arrangement of plate spring assembly for spring-mounted generator

Some more accurate methods of calculating flat springs and leaf springs of simple form have been outlined. These indicate that in certain cases the effect of axial loading and large deflection should be considered for best results.

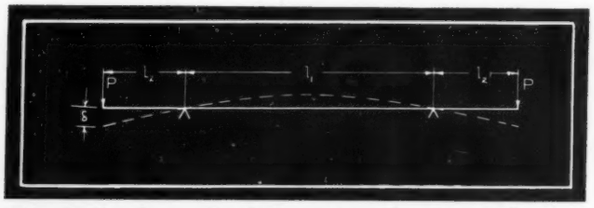


Fig. 7—Loading of plate spring showing deflection

Calculation of more complicated leaf springs and rational determination of working stress for them under fatigue loading will be considered later.

Air conditioning and high intensity lighting increases efficiency in the Detroit Edison drafting room. Control of temperature and humidity reduces chance of smudge on drawings and eliminates trouble from changes in dimensions of tracing cloth.

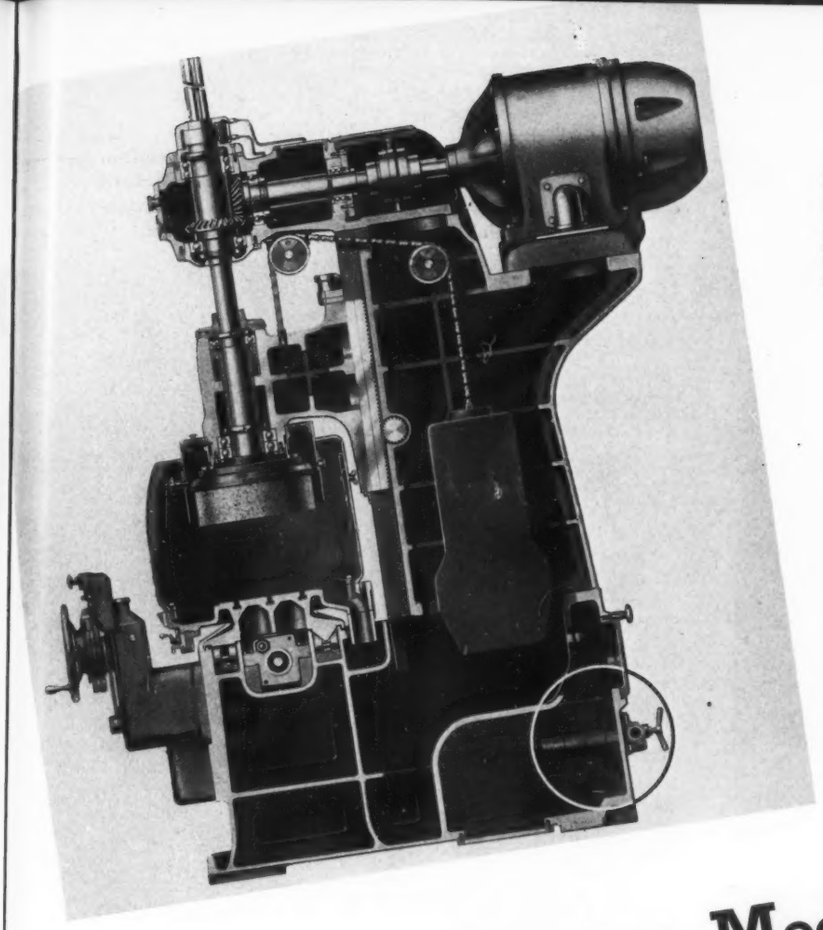
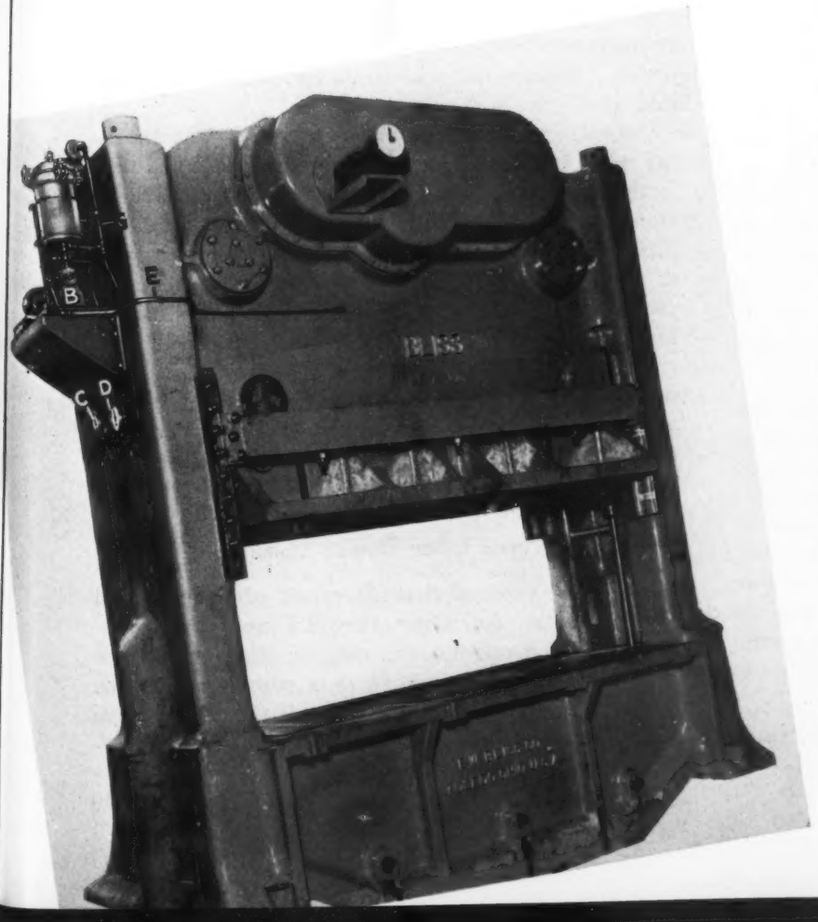


Fig. 1—Left—Filter on vertical surface grinder handles oil used to operate table. Fig. 2—Below—Lubricating oil is cleaned by filter on large drawing press for fabricating automobile bodies

Oil Filters Protect Modern Machines—If Properly Applied



MANY important factors must be considered if filters are to guard effectively against foreign particles in lubricating, hydraulic and fuel oil systems of modern machines, with their high speeds and precision. A wide variety of filters is available, which, although they serve the same purpose and operate along similar lines, differ greatly in construction. Hence this article will concern itself only with general principles to be borne in mind by designers when planning the use of oil filters.

One of two kinds of protection may be required of filters: Dirt may be continuously removed, as in engine lubricating oil where sludge is constantly produced within the system; damage from stray particles may be prevented as in hydraulic oil where the system is closed and essentially clean. Matters such as filter size, location and provision for cleaning will depend in great part on which of these two functions the filter must perform.

A filter should also be chosen in the light of whether it is to handle what is often called a partial flow or a full flow of the system. Properly designed, a partial flow system will keep the percentage of sludge below a

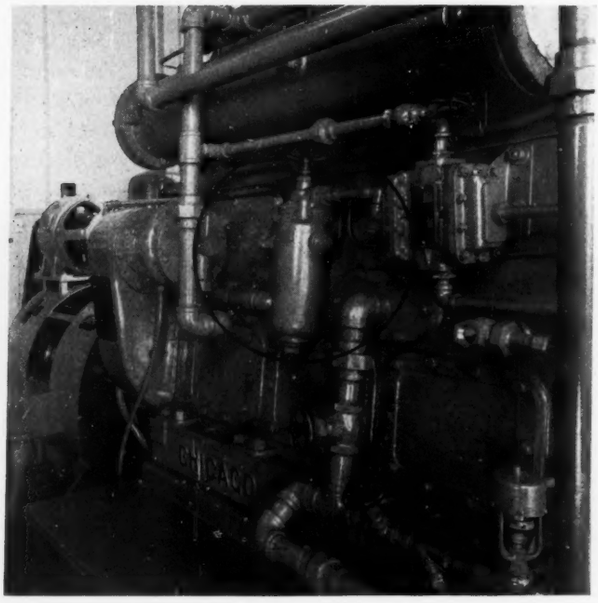
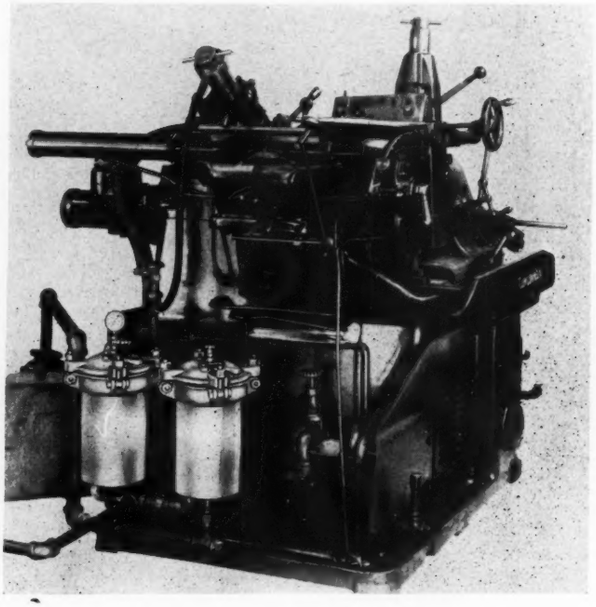


Fig. 3—Left—Permanent type filter used on diesel engine, where it purifies lubricating oil. Fig. 4—Below—Coolant compound is handled by replacement type filter on centerless grinder. Formerly a settling tank was used



given maximum content but will not provide positive protection. That is, any particular particle of sludge cannot be prevented from recirculating. A full flow system will prevent recirculation of all solids larger than the spacing of the filter. But limitations of size and weight often hinder filtration as fine as is obtainable with a partial flow system.

Two Full Flow Examples

Two full flow examples are shown in *Figs.* 1 and 2. The former illustrates an application of a filter with a steel cartridge to a vertical surface grinder. Hydraulic oil used to operate the grinder table is handled by the filter. *Fig.* 2 depicts a familiar use of a filter for purifying the lubricating oil on a large drawing press for automobile bodies. Actually a motor driven oil circulating pump is used in conjunction with the filter. Each bearing and the gear teeth receive a constant flow of oil, which drains down into a large receiving pocket in the slide, whence it is drawn back, filtered and pumped into the system again. Inlet and outlet pressures to the filter are indicated by the pressure gages, and when the differential is about 20 pounds, the filter bags are removed, cleaned, and replaced.

In general, it may be said that a filter should not be put on the suction side of the oil pump unless there is a special reason for doing so. A filter installed on the suction side usually must have two to three times the capacity of one installed on the pressure side or on the return line because the pressure drop across the filter must be held well below the point where pump cavitation can occur. Pump suction characteristics vary widely and should be carefully considered in selecting the proper location for all types of filters.

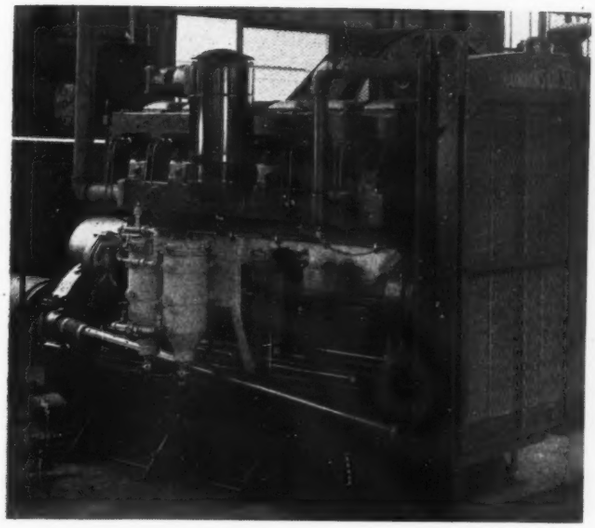
But the problem of deciding which side of the pump should receive the filter is not as simple as it may seem. An entire system is protected by a filter installed on the pump intake line, while a filter on the discharge side does not protect the pump. A smaller unit, at consequent lower cost, may be used in the latter case, however. Moreover, a return line installation protects the system from all sludge produced by the system but does not protect it from dirt introduced with the fluid. Again, special restrictions will govern filter location. Hydraulic control systems in aircraft, where size, weight and accessibility are of primary importance, provide an excellent example of this type.

Two other precautions merit mention. The filtering element should not be too small and ultra-fine spacing in special elements should not be demanded. Manufacturers' data sheets usually give dimensions of filter elements available in various sizes for each type or model. Tables are also available showing capacities at a given pressure drop for all available spacings over a full range of viscosities. Instead of fine spacing, the area of the filter may be increased to reduce velocity through the unit. Within the limits of ordinary lubricating, hydraulic and fuel oil service, capacity varies in approximate proportion to viscosity and pressure drop.

Filters Often Blamed Unfairly

It is to be expected that filters will often be blamed for difficulties for which they are not directly responsible, and one instance may be cited. Excessive bearing failures were noted in a number of trucks, all of which were equipped with oil filters. Because the filters contained an abrasive as one of the filter-

Fig. 5—Below—Thousands of flexible disks are held in stacks under spring tension in the filter on this diesel. Number and length of packs depends on capacity



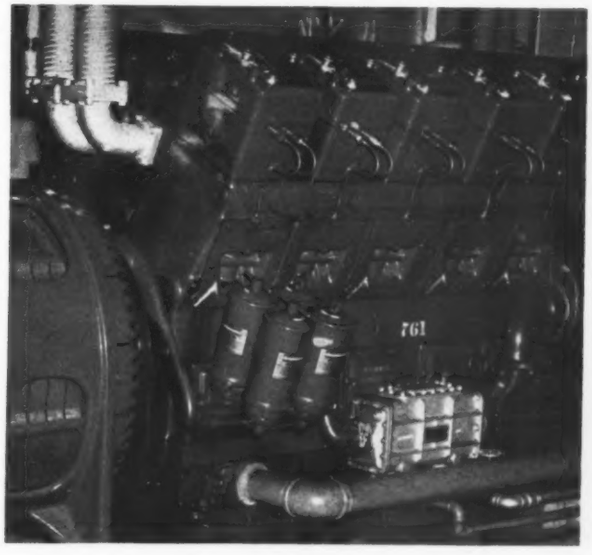
ing mediums, the failures were believed to result from disintegration of the abrasive and its being washed back into the crankcase oil, where it was thought to be picked up and circulated to the bearings. Investigation showed, however, that the filters had been installed at the center of the bearing galley header and that a restricting orifice had not been used. Pressure was found to be about 12 pounds too low, and undoubtedly the lack of pressure had robbed the bearings of proper oil. Installation of orifices restored pressure to the right figure.

Consider Relative Merits of Types

Filters are either replacement or permanent types, and the relative merits of each should be considered. Fine filtration is afforded by the replacement type at low initial cost, but either the filtering element or the entire unit must be replaced frequently. The filter in *Fig.* 4 is a replacement type with removable element, and is applied to a centerless grinder where it purifies the coolant compound. Formerly a common settling tank was used, but grit was recirculated through the machine and caused grinding wheels to wear much faster and induced rough spots on finished shafts. These troubles have been eliminated. The filter on the diesel in *Fig.* 5 might be called an intermediate type between replacement and permanent kinds. It comprises thousands of flexible disks held in stacks under spring tension, the number and length of the packs depending on the capacity of the unit. In cleaning, the flow is simply reversed through the filter by compressed air, the clean oil around the spring being forced back, dislodging the accumulated solids so that they drop to the bottom of the filter. *Fig.* 7 shows another application of filters on a diesel engine.

Permanent type filters are available with spacings

Fig. 6—Above—Because of its unusual nature, this machine for manufacturing metal molding owes much of its dependability to its oil filter, which removes fine metal particles from lubricating oil. Fig. 7—Below—Another application of filters to a large diesel engine



sufficiently fine for almost all services. While the initial cost is higher, most important advantage of this type is the fact adequate filtration is not dependent on periodic cartridge replacement. An example of such a filter is installed on the diesel engine in *Fig.* 3, where it handles lubricating oil. The cartridge, as in *Fig.* 1, is steel.

After the questions discussed thus far have been settled, another problem presents itself in the application of filters: Shall they be installed as a separate unit mounted to external pipe connections, or shall they be built into existing space in the machine? Without doubt the latter course is the more modern and offers the advantages of improved appearance,

(*Concluded on Page* 94)

On regular airmail service, this autogiro is being used in all weather conditions to test its serviceability. Below—Hub and controls for rotor. Rotor requires starting power only

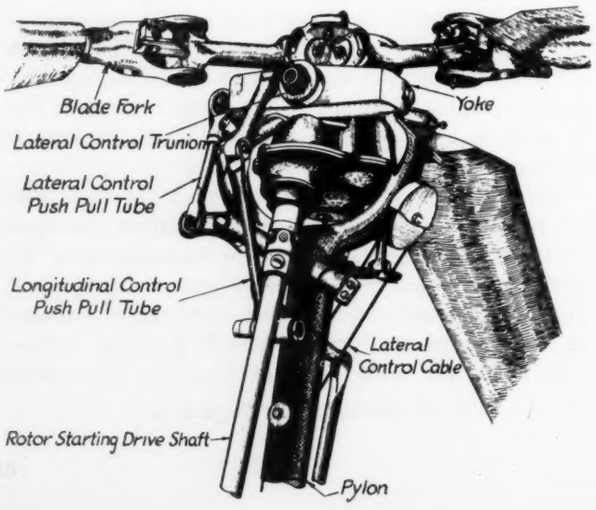
Autogiro Has High Service Factor

TO DETERMINE its serviceability with respect to weather conditions, this autogiro is equipped with instruments and features in addition to those usually necessary. The ship, designed by Kellett Autogiro Corp., flies airmail regularly between Philadelphia and Camden and has maintained a schedule considerably over 90 per cent operation in the few months it has been in service.

Cockpit and mail compartments are entirely enclosed as protection against weather. Pilot has high visibility through plexiglas windshield and windows as shown in the illustration. Steel tubing is used throughout entire fuselage structure, all bracing being welded tubular steel diagonals and cross members. Gussets are employed at all major intersections and fittings are wrap-around type of sheet steel.

Fire wall is stainless steel. Sheet aluminum alloy cowls the forward part of the fuselage. Lateral fairing supports are metal bows of duralumin tube. Pylon strut fairing is aluminum sheet fastened to duralumin channel and steel bows attached to the pylon strut.

In its essentials, the pylon structure is a single heat treated steel tube designed to carry the rotor loads in cantilever. The strut extends to the lower truss of the fuselage where it transmits the principal lift loads. Just above the upper fuselage truss, a tri-member tubular structure supports the pylon in such a way that all torsion and bending are taken at this point. The upper end of the pylon strut terminates in a tubular fork which carries the yoke and hub of the rotor.



This hub, shown in the drawing, consists of an axle including pivots for the horizontal blades and a hub case carrying in addition to the main rotor hub bearings, the spiral bevel ring gear and pinion of the rotor drive. All bearings for these parts are needle or ball. The main hub case, a two-piece magnesium casting, carries the lower main hub bearing and also the drive pinion. To the top of this case is bolted the hub cap, a machined, heat-treated forging.

The upper main hub bearings fit under the shoulder of the hub cap which incorporates the axle for the lateral tilting of the hub. Thus the hub cap carries the principal rotor flying loads. Only the driving torque and radial load from the lower axle bearing are transmitted to the magnesium hub case. From this hub cap, the flying loads are transmitted to the main aircraft structure through a machined heat-treated steel yoke.

High strength steel tubing forms the main structure of the rotor blades. An auxiliary tip spar of the same material is built into the outer extremity of each blade with four welded webs. Plywood ribs and cover supply the contour, the entire blade being covered with doped fabric.

To control and limit oscillations of the rotor blades about the vertical pivots, each blade is equipped with an internal spring-loaded, damped plunger actuated by a double noded cam. This cam engages a roller located in the fork arms on the plunger. By this

(Concluded on Page 86)

Whither Styling?

Foremost industrial designers discuss trends in styling of machines. This subject is vitally important because of its relation to both appearance and utility—factors which always must be considered in design projects.

" . . . integrate essential forms"

Walter Dorwin Teague
New York City

MACHINE styling should be controlled by an analysis of the operation which the machine is intended to perform and the operator's movements in controlling it. The "decoration" of a machine—or of anything else made to serve the utilitarian purposes of this age, for that matter—is completely out of place and should be carefully avoided.

The essential forms of the machine should be organized and integrated, eliminating any features or details which are not necessary to its construction or operation. Controls should be placed where they are most convenient to the operator's hands and they too should be simplified as much as possible.

In many cases machines have grown and greatly improved without much thought being given to the organization and simplification of their forms. We have found for instance that in some cases three or four different kinds of knobs or levers are in use on the same machine for no reason whatever. We have also found that three or four entirely different kinds of nameplates have been cast into or attached to the various parts of a single machine. In some cases guards have been added as an afterthought and have not been unified with the machine as a whole. A careful study and replanning of the whole machine will result in replacing this entire collection of odds and ends with a single type of knob, lever or nameplate.

As a result of this type of replanning the efficiency of the machine is often measurably increased. The controls are placed more conveniently, are properly accented, and become more familiar to the operator's hands. Reductions in cost often can be effected through the elimination of parts and the simplification of assembly operations.

As a result of these basic improvements the machine is very much better looking; the operator takes pride in it and gives it better care. But these results have come about not because the designer set out to make it a pretty machine; they are the natural and logical results of his efforts to make it a better machine.

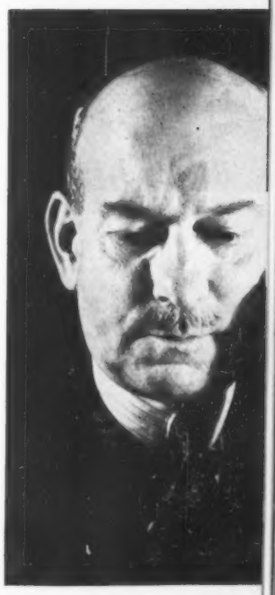
" . . . easy to make good looking"

Henry Dreyfuss
New York City

APPEARANCE design is an accepted factor in selling. Automobiles, refrigerators, toasters, washing machines, vacuum cleaners, are now objects pleasing to the sight. The manufacturer has learned that eye appeal is an effective silent salesman.

But those who design machinery which is seldom or never seen by the consumer often question the advisability of paying attention to appearance. Recently a manufacturer whose machines are renowned for their mechanical excellence asked whether a machine such as his, so seldom seen except by the operators, might be bettered by improved appearance.

The answer is threefold: First, as a matter of selling, given machinery of equal mechanical proficiency and within a similar price range, I believe the purchaser is definitely attracted to the best looking machine. Second, an operator of a machine can do better work in pleasant, comfortable, convenient surroundings. Third, people sometimes forget that industrial design often achieves good appearance by eliminating discomforts and inconveniences to operators. To make a machine easier to operate, to make a package easier to handle, is one of the basic purposes of good design. Certainly all these factors should begin with the actual machine on which the designer is working and

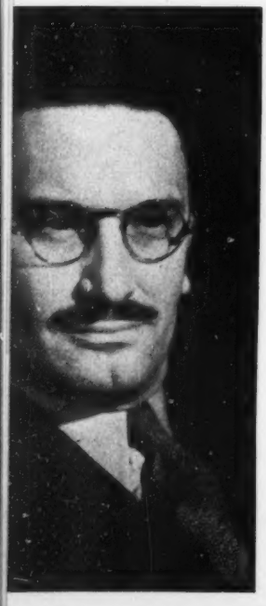


Walter Dorwin Teague

Henry Dreyfuss

Harold Van Doren

Wilbur Henry Adams



Egmont Arens

be supplemented with good light, cleanliness, and adequate ventilation.

It is just as easy, just as reasonable to make an object good to look at, as to make it nondescript in its appearance.

"...styling expresses character"

Harold Van Doren
Toledo, Ohio

AT PRESENT there is much similarity in form between objects of entirely different natures. There is a tendency to wrap everything in metal "packages," all looking much alike. Such similarity should be avoided because in gravitating toward a common level machines will lose their distinctive character. In machines manufactured in limited quantities this is perhaps natural because the trend is toward covering up unsightly agglomerations of mechanical parts and protecting them not only from the eyes, but from dust, etc. Further, with items of limited production, it is natural that the cost be held within a fabrication standard because tooling would be relatively expensive.

Surfaces curved in more than one direction, that is, freehand swells, require dies to produce. Such shapes are common enough in consumer merchandise where volume is large, but applications are limited for metal enclosures on commercial equipment and capital goods. There is, however, a definite trend from square corners toward rounded corners in industrial machinery. Unfortunately, fabrication methods are rather limited and they place restrictions on the imagination in producing interesting shapes which reflect more truly the actual function of the machinery inside.

Sometimes a restyling job can be performed by merely making minor changes to the exterior. This, however, is often not possible. It is then necessary to start from scratch working out the problem from both the engineering and styling angles. In this way a thorough-going design can be accomplished. Design treated in this way is more expensive at the outset perhaps but gives better results in the long run.

"...must look real"

Wilbur Henry Adams
Cleveland

INDUSTRIAL styling of a machine requires that it must look real. It must appear strong and positive. It can't look too "pretty"—but should portray the power and accuracy it houses.

Some machines or machine parts demand symmetrical forms and others nonsymmetrical. When the latter is used, there is much opportunity for ingenuity in styling. For instance, instead of wasting space the housing may be continued to conform to the shape of the mechanisms or the actual flow of products into and out of the machine. These shapes have more romance and character in that they are more interesting in appearance.

To gain strong appearance, surfaces should be kept simple and smooth. Gadgets as such should be carefully avoided. However, if femininity is desired surfaces should be broken up with fine detail.

Scale or relative size is always important when styling a machine. Whether big or little, from where it will be viewed, determines the type of treatment best to use. Size with respect to man and surroundings controls the styling possible. For instance fine lines or trim would not be useful in styling a big machine which can only be viewed at a distance whereas such treatment is very effective for smaller size projects.

One may wonder why a machine should be attractively styled. This can be answered by a review of new projects such as power houses, dams and modern factories. They are all architecturally modern and simple. Why shouldn't the equipment be of the same characteristics? With the construction of modern, well-lighted factories, machines must coincide with the new spirit brought out in the building.

The idea is becoming more and more remote that a machine to be well designed and styled must be completely or nearly completely housed or covered up. The beauty in a machine rests in the working parts—there is a definite beauty to gears, fly wheels, etc. that should not be lost. Only certain ugly or dangerous parts should be covered or concealed, the others should be exposed.

"...smoother and rounder lines"

Egmont Arens
New York City

RECENT years have brought new types of factories into existence. Whole plants have been designed with greater emphasis on appearance and style, not primarily for those objectives alone, but also because new materials and architectural developments have made possible more efficient plants.

Some of the best examples of this trend are the Johnson's Wax plant designed by Frank Lloyd Wright, the Campana Italian Balm plant, and the Kimble Glass plant in New Jersey.

Manufacturers who have invested heavily in modern buildings have seriously questioned why they should install unattractive equipment in their well-ordered plants. That this questioning has produced effects is shown by the increasingly larger amount of machinery which has been designed with more thought to appearance-value. Happily, this greater attention to appearance is usually accompanied by increased efficiency.

When the idea of redesigning of industrial equipment began to take hold, the first attempts were along the "modernistic" or "prettying-up" lines which consisted mainly of adding housings which had a multitude of angles, step-downs, or non-functional curves used without regard for the machine's use or surroundings; or by such "tricks" as adding strips of chromium moldings profusely around the machine. This was a natural result and paralleled the early days of package and consumer goods redesigning.

We are now entering the next phase in styling which has already been reached to a large extent in the consumer goods fields. This is exemplified by many of the smooth-lined electric appliances. The machine industries are now seriously entering this second phase and greater benefits to industry are resulting. New materials and improved designs will make for reduced costs, easier assembly, greater eye-appeal and easier cleaning of equipment.

Obvious future developments in the machine field would seem to be greater emphasis on eye-appeal, smoother and rounder lines, increased use of new materials such as plastics and alloys even now in the development stages. These will give us equipment which will be both esthetically satisfying and efficient.

" . . . study operators' ability"

Herbert Rosengren
Woodcliff Lake, N. J.

OBJECTIVE of all modern machine design is to simplify or eliminate hand labor; a by-product of this effort toward simplification has been higher productiveness of both man and machine. Machines are successful according to their adaptability to the operators. It is Mr. Average Operator who determines the effectiveness of the machine itself, and it is his work which gages the value of industrial design effort. Therefore, we should ask ourselves if machines today bring the operator into a more harmonious relationship with his work.

Right now the entire engineering and manufacturing field could benefit by a careful study of the abilities, physical and mental, of the twentieth century artisan (distinguished from the old handicraft worker by his use of *production* rather than *hand* tools) who is the human and thinking part of machine ensemble. If we could establish a standard operator, know more definitely how much he can lift, how far, and for how long, know how much light he needs, how much noise he can tolerate, how much monotony he can endure—if we knew these factors along with his physical dimensions, we could really design machines to fit him. True, a great deal of effort is being directed toward work simplification by specialists in that field; however, the work simplification today seems to raise the standard of productiveness of hand work in competition with machine work. We need the same kind of study applied to operator and machine together. With these elements clearly defined it is possible to come closer to the objectives of design.

Styling of complete unified production lines in the user's plant and to his requirements may indicate a new trend in machine styling. It may be that machines for this type of use will be sold stripped of all guards, just plain mechanisms, to be styled by the client; or industry at large may adopt some system for all machines so that any combination of machines will harmonize and function as a unit.

Design of tomorrow will be much wider in scope. Not alone the individual machine, but the total industrial environment will be the source of the design idea. Not one machine, but many machines together in the modern factory. And, not only the machines, but the factory itself will be integrated into a unified, efficient, balanced whole.

" . . . incorporate sales appeal"

J. O. Reinecke
Chicago

LEADING manufacturers of industrial equipment are now squarely facing the fact that their machines are merchandise—not a robot to be sold on the strength of

(Continued on Page 82)

Herbert Rosengren

J. O. Reinecke

Raymond Loewy

Advantages of Stainless Wire May Offset Cost

By Stanley P. Watkins
Rustless Iron & Steel Corp.

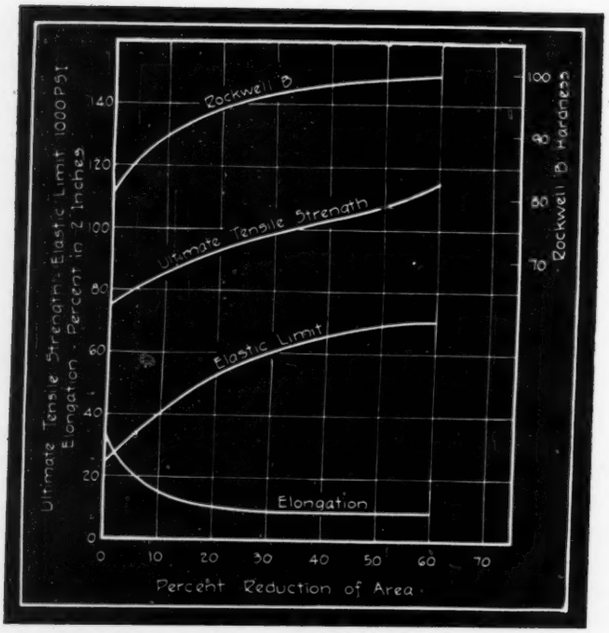


Fig. 1—Effect of cold working on straight chromium stainless steels capable of being heat treated. Tensile strength and hardness is increased

THREE distinct types of stainless steels which, in the form of wire, may be worked into shapes with design importance, result from variation of the combination and proportion of the alloying elements.

Straight chromium stainless steels capable of being hardened comprise one group, some of whose properties are shown in Group I, TABLE I. The low carbon alloys of this group have excellent corrosion resisting properties in all conditions of heat treatment, but the higher carbon alloys need to be fully hardened to develop maximum corrosion resistance. These steels possess relatively low work-hardening susceptibility, but their tensile strength and hardness can be increased by cold working, as in *Fig.* 1.

In the annealed condition, alloys of this group have good ductility and in wire form may be readily cold upset, swaged and woven into screens. The only exception is the 12 per cent chromium free-cutting alloy, which contains a high sulphur content and consequently is less suitable for cold upsetting and swaging. Heat treated, these steels have high hardness and tensile strength which renders them particularly suitable for applications such as spring, auto radio parts and metal drive screws. They have a tendency to harden in welding, however, hence are not as satisfactory as the 18-8 alloys for certain purposes involving resistance welding.

The second group whose properties are shown in Group II, TABLE I, are straight chromium stainless steels which are nonhardenable but are more corrosion-resistant because of their higher chromium

From a paper presented before the annual meeting of The Wire Association.

TABLE I

Composition and Physical Properties of Three Groups of Stainless Steels*

	First Group	Second Group	Third Group
Carbon	.15 max. to 1	.12 max. to .35 max.	.12 max. to .2 max.
Chromium	10 to 18	14 to 30	18 to 26
Nickel	.5 max. to 2 max.	.5 max. to 1 max.	8 to 14
Sulphur	.15 min. in one grade	.15 min. in one grade	.15 min. in one grade
Molybdenum			2 to 4 in one grade
Ultimate tens. strength—1000 lbs./sq. in.	75 to 285	75 to 100	85 to 350
Yield strength—1000 lbs./sq. in.	40 to 275	45 to 90	35 to 300
Elong., pct. in 2 in.	35 to 115	8 to 35	5 to 60
Rockwell hardness	75 to 90-B 40 to 60-C	75 to 100-B	75 to 80-B 35 to 50-C
Electrical resistance, microhms/CM³	57 to 60	60 to 67	71 to 78
Thermal conductivity, C.G.S. units at 100 deg. C.	.057 to .06	.05 to .055	.035 to .05
Thermal expansion, per deg. C., 0 to 100 deg. C.	.000011 to .0000115	.0000106 to .0000115	.0000149 to .0000171

* The values shown in the table are presented only for comparison and include the maxima and minima for the various grades in each group.

content. They cannot be hardened by heat treatment but cold working may increase this factor to some extent. This group are also applicable to severe cold upsetting, swaging and forming operations, the 18 per cent chromium grade being particularly suitable. Careful technique is required, but these steels are adaptable for resistance-welded parts.

Typical of the third group is the well-known 18-8 stainless steel. Properties of these steels are given in Group III, TABLE I. They are normally nonmagnetic and not capable of being hardened by heat treatment. All these alloys respond to cold working, however, and the combination of unusual physical properties and resistance to practically all corrosive agents makes this group the most widely used group of stainless steels. They may be readily swaged, formed, cold upset and woven into screens, have excellent welding characteristics and in the 25 per cent chromium—12 per cent nickel grade offer exceptional resistance to scaling at elevated temperatures up to 2000 degrees Fahr. The difference in work hardening characteristics between low and high alloy 18-8 stainless wire is illustrated in *Fig.* 3, while *Fig.* 2 shows the influence of carbon content on the work hardening of the same wire.

As the tables show, chromium and nickel are by far the most important elements added but others may be used to impart special characteristics. Molybdenum increases corrosion resistance and silicon protects against scaling and oxidation at high temperatures. Sulphur and selenium, in amounts above approximately .15 per cent, give free-cutting and nonseizing characteristics. Tungsten additions increase strength at high temperatures and titanium and columbium are helpful in preventing carbide precipitation in the 18-8 alloys, thus reducing their susceptibility to intergranular corrosion. In addition, carbide precipitation in the 18-8 steels can be effectively controlled by lowering the carbon content to below .07 per cent.

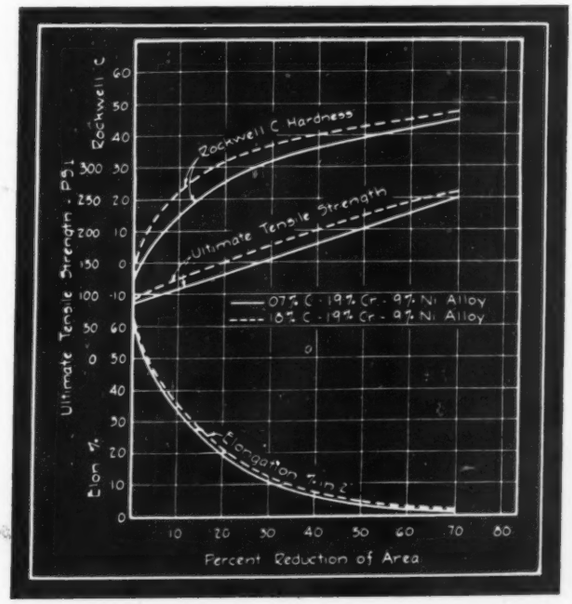

Rockwell C
Ultimate Tensile Strength - PSI
Elon %
Rockwell C Hardness
Ultimate Tensile Strength
.07% C - 19% Cr - 9% Ni Alloy
.10% C - 19% Cr - 9% Ni Alloy
Elongation % in 2"
Percent Reduction of Area

Fig. 2—Influence of carbon content on the work hardening of 18-8 stainless steel wire, incapable of being hardened by heat treatment

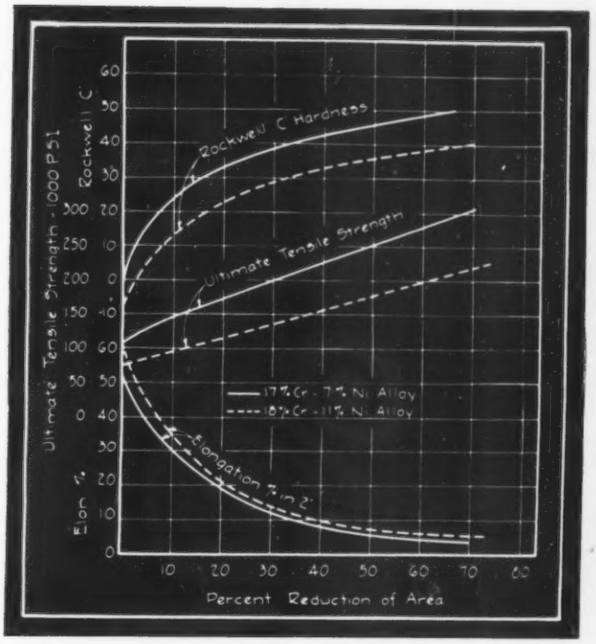

Rockwell C
Ultimate Tensile Strength - 1000 PSI
Elon %
Rockwell C Hardness
Ultimate Tensile Strength
17% Cr - 7% Ni Alloy
18% Cr - 11% Ni Alloy
Elongation % in 2"
Percent Reduction of Area

Fig. 3—Difference in wor hardening characteristics between low and high alloy 18-8 stainless. This is most widely used stainless steel, but nonhardenable by heat

Certain applications of stainless steel wire are interesting because of the light they shed on fabricating possibilities. In processing the wire for making screws and rivets, the wire is drawn .003 to .005-inch oversize, "bright" annealed, coated and drawn to finished size. The skin pass serves to iron the coating and slightly raise the temper of the wire which improves heading qualities. Although the 18-8 analysis cold heads satisfactorily, some advantage is gained by raising the nickel content from 8 to above 10 per cent. Higher nickel reduces work hardening.

Because of the ability of the 18-8 steels to work harden when cold drawn, they are well suited for making springs and high tensile wire. The modulus of torsion for 18-8 spring wire averages about 10,500,000 pounds per square inch, but may vary between 9 and 11 million. When these springs must maintain great accuracy, the recommended maximum operating temperature is 350 degrees Fahr., but they can be operated at considerably higher temperatures without entire loss of spring properties. For most applications, it is advisable to temper springs made of 18-8 wire in the range of 400 to 800 degrees Fahr.

Stainless steel in wire form offers virtually the same advantages as it does in other forms. Its range is wide, it combines strength and durability, it lasts longer. Often these values more than offset the higher initial cost, the added attention and time in fabricating and the increased tool cost.

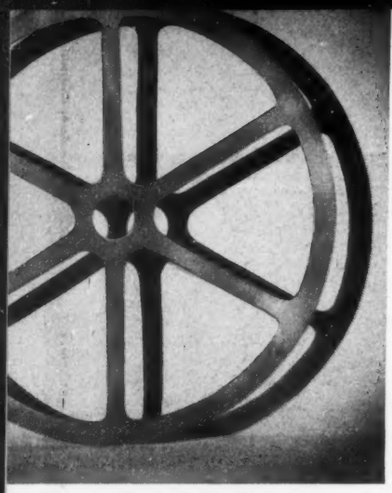


Fig. 1—This beryllium copper selector disk for a scale has 525 cut teeth on 10-inch diameter

Will Beryllium Fill a

By George Z. Griswold

BERYLLIUM presents the strange paradox of a metal whose oxide was discovered in 1797 but which still remains a mystery to a great extent. Research in recent years has indicated the possibilities of beryllium as an alloying element and perhaps even as a structural metal, but at the present time its potentialities can hardly be guessed. This article, therefore, will merely outline the progress thus far; as more information of design significance becomes available, it will be discussed in MACHINE DESIGN.

With specific gravity (1.84) almost the same as magnesium, beryllium for practical purposes is the only light metal with a high melting point, 1285 degrees Cent., about 600 degrees Cent. above magnesium and aluminum. Its pure oxide melts at 2570 degrees Cent. Lack of ductility, however, has proved a serious stumbling block as far as use of pure beryllium as a structural metal is concerned. Although European reports have stated extremely pure beryllium is ductile, and hot-rolled sheets .02-inch thick have been bent somewhat in the laboratory while still hot, no commercial quantities of the metal have been produced which exhibited ductility. At ordinary room temperatures even almost pure metal has had very low elongation. There is always the possibility, however, that too much importance is being attached to the factor of ductility. Should this difficulty be surmounted in any way, beryllium, with its remarkable resistance to corrosion, its greater rigidity than steel and its coefficient of expansion about equal to that of cast iron, may assume tremendous influence in metallurgy and design.

Largest Use Is As Copper Alloy

The largest commercial use of beryllium is for alloying copper. Indeed, beryllium is to copper almost what carbon is to iron, in that beryllium in copper in amounts analagous to those of carbon in iron imparts properties to the copper which resemble those of steel. Moreover, beryllium copper is hardenable by heat treatment in similar manner to steel, and third and fourth metal additions are likewise beneficial.

As with most comparisons, however, the above similarity cannot be carried too far. Steel can be heat hardened with diminishing carbon content to .1 per cent; binary beryllium copper will not heat-harden when the beryllium content is less than about 1 per cent. Third metal additions such as iron, cobalt, nickel and chromium, however, will permit the beryllium to be lowered to as little as .1 per cent.

There is another salient difference in the copper-steel analogy. Steel when first heat treated and quenched emerges hard and brittle, and reheating it to low temperatures serves to temper it. Beryllium copper is soft and ductile after first heat treatment and another heating is necessary to harden it. It is significant that the first heat treatment of beryllium copper leaves it in the state where it can be

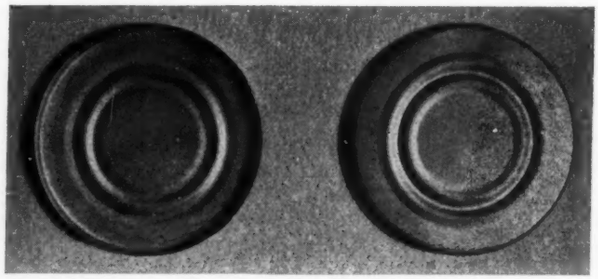


Fig. 2 — Above — Diaphragm for a refrigerator valve. Cobalt was added

Fig. 3—Right—A fuse contact spring, formerly pure copper with steel backing

Fig. 6—Fractional percentages of iron and nickel were added to the alloy for this retractable landing gear ring

Larger Niche in Design?

finished by machining, stamping or drawing. The table below for example, gives the approximate physical properties after heat treatment of sand-cast alloys containing 2.75 per cent beryllium, the remainder principally copper.

Ultimate tensile strength, lbs./sq. in	150,000
Ultimate compressive strength, lbs./sq. in.	190,000
Elastic limit, lbs./sq. in.	135,000
Elongation, per cent in 2 inches	1
Hardness, Rockwell C	40-42

As will be seen, this alloy has a higher compressive strength than that found in some mild steels.

Principal interest in beryllium-copper alloys has centered about analyses containing from 1.5 to 2.75 per cent beryllium, balance mainly copper. Nickel of .25 to .5 per cent is sometimes added to restrict grain size during annealing and cobalt of .5 per cent

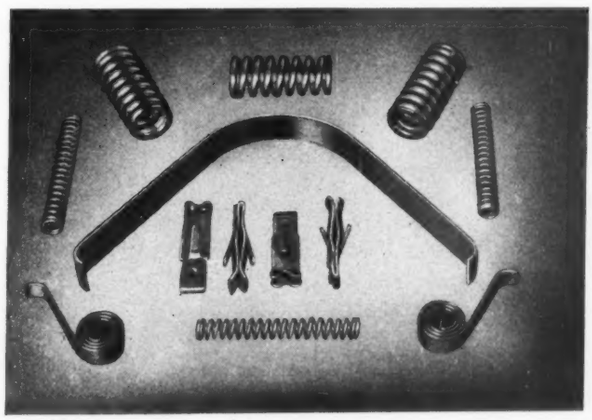


Fig. 5—Above—Flat and coiled springs and appliance plug clips, showing spring properties after heat treatment

Fig. 4—Left—Adjustable pitch propeller hub cones, also beryllium copper

permits the beryllium to be dropped to 1.8 per cent, the alloy as a whole retaining its hardness as obtained from heat treatment. Again, alloys of .4 per cent beryllium and 2.6 cobalt have electrical conductivity more than 45 per cent that of copper itself.

Working possibilities of beryllium copper are indicated by *Fig.* 1, a selector disk for a scale. It is .045-inch gage with 525 teeth cut on a 10-inch circle. Analysis for the diaphragm for a refrigerator control valve, *Fig.* 2, is beryllium 2 per cent, cobalt .35 per cent, balance copper. It has been found that the addition of a small amount of cobalt, .2 to .5 per cent, will greatly improve the uniformity of physical properties of this type of alloy after heat treatment. By lengthening the time and widening the heat treatment range, cobalt tends to make the alloy more foolproof at the hands of inexpert operators.

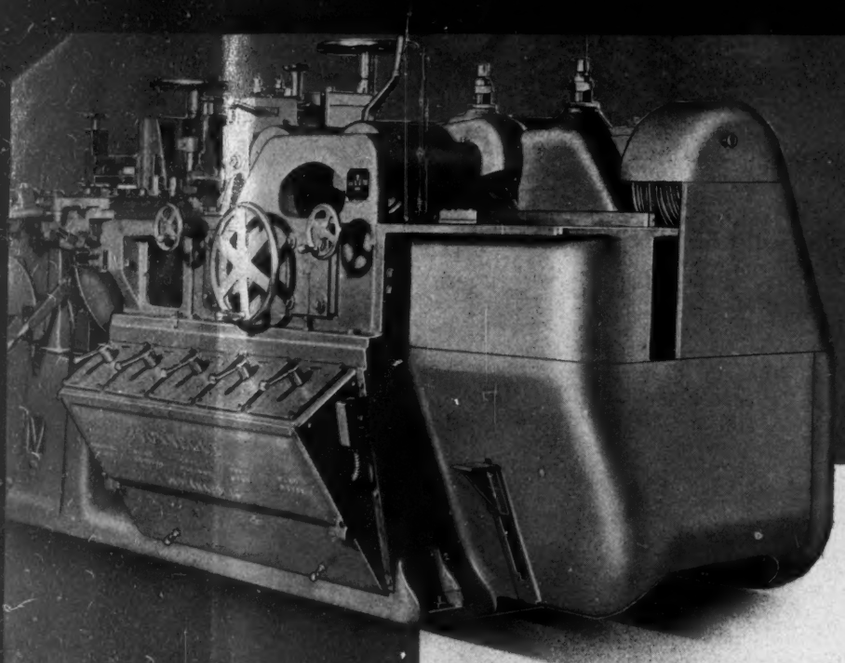
Fig. 3 shows a fuse contact spring in a cutout switch, composition being .5 per cent beryllium, 2.6 per cent cobalt, balance copper. In this instance, the beryllium copper alloy is formed in the dead soft condition and then heat treated to full spring properties. The example illustrates an important design advantage of this alloy, since it replaced pure copper with a steel "backing up" spring.

Heating Gives Spring Properties

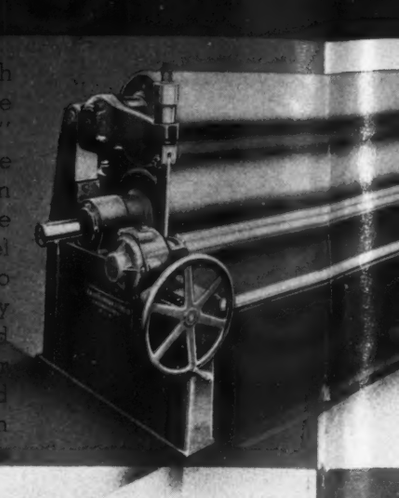
Figs. 4, 5, and 6 show respectively adjustable pitch propeller hub cones; flat and coiled springs and appliance plug clips; and a retractable landing gear ring. These parts are made of beryllium copper containing 2 to 2.25 per cent beryllium, .25 to .50 per cent nickel, approximately .10 per cent iron and the remainder copper. *Fig.* 7, showing solderless connectors used in automotive lighting systems in place of soldered joints, illustrates another beryllium-copper alloy with cobalt around .35 per cent. The ability of beryllium copper to be formed readily in a soft temper and then heat treated to excellent spring properties, is evident.

Other metals, including silver, nickel and manganese may be added to beryllium copper. Silver may comprise as much as 70 per cent of the alloy with beryllium around 1 per cent, or silver may be as little as 5 per cent, conductivity ranging from approxi-

(*Concluded on Page* 78)



Pressure is kept uniform on both sides of the Butterworth dye padder (right) by a "micro-set" feature, a method of preloading the springs which are mounted in an enclosed casing on top of the pressure levers. The handwheel shown applies pressure and also separates rolls, through a fully enclosed grease-tight worm and gear. Drive comes from a gear reduction motor, but compound gears are optional. Rolls run [illegible] roller bearings



Design Fe
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A Pictorial Presentation o
chinery from the Standpo

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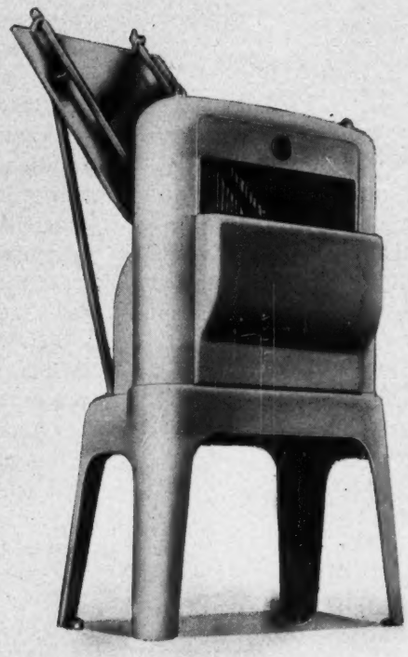
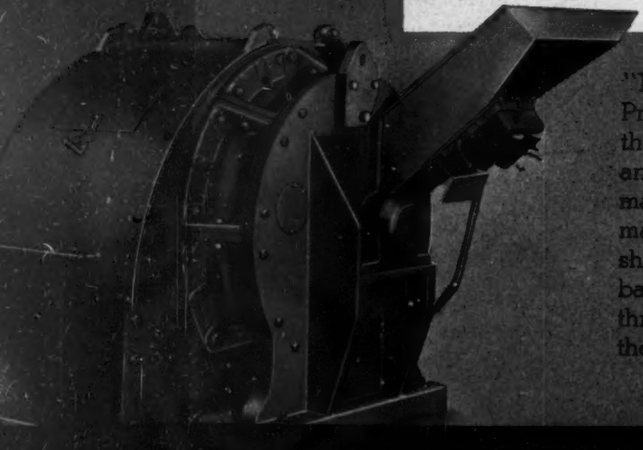
A two-speed feed motor in the Vonnegut electric molder (above) transmits power by V-belt through a four-step pulley and a totally enclosed worm reduction to four cutterhead spindles which form or shape four sides of wood simultaneously. Each spindle has lateral and longitudinal adjustment and the two vertical spindles also have angular adjustment. Nearly all parts above the table are steel or steel castings. Worm and spindles run on ball bearings, slower speed rolls and shafts have bronze bushed bearings



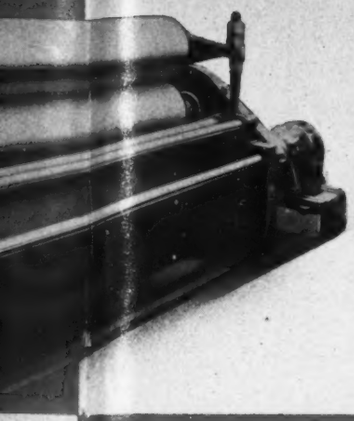
A pair of eccentrics drive two aluminum frames bearing specially toothed blades in the Gellman bread slicer (right). These blades in effect saw the bread. Vibration is automatically balanced out because the frames operate in opposition. A ¼-horsepower motor drives the mechanism through a double V-belt. When a loaf of bread is in place, a micro-switch on the pusher bar turns on the machine and stops it when the loaf has passed through the blades

THIS MONTH'S COVER. Each two brand new Eagles is powered by diesel engines, fed from a 1200-gallo engines idle at 275 revolutions per mi at 800. Maximum running speed is miles per hour, with power in reserve direct-attached generator with a maxi volts and three electric speeds. Six a each train and were styled by R

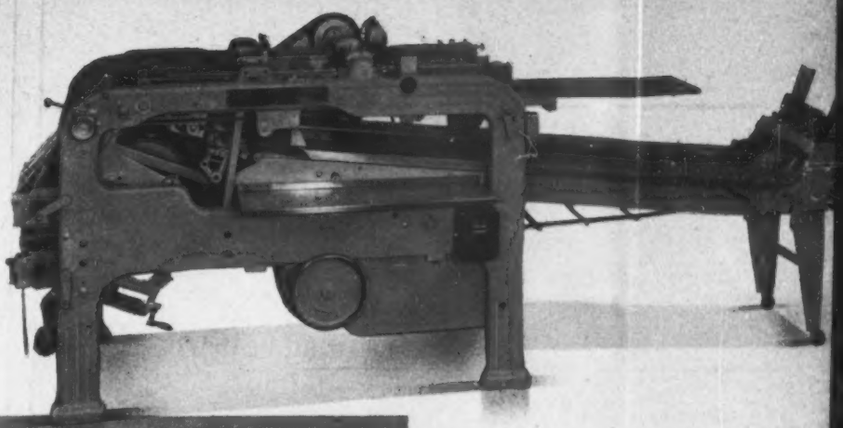
Drawn steel is specified for the Smith electric pencil sharpener is direct, coupled to the shaft of t induction type motor. Cutters a steel, spiral cut, pack-hardened Bearings are self-aligning, oil-le lubrication only once



"Triple reduction" operation features the Prater mill (left), breaker bars smashing the material, crushers combining cutting and crushing action to distribute the material, and rapid-fire hammers reducing material to size. Unusually large rotor shafts run in self-aligning, dust sealed ball bearings. Construction is steel throughout. Rotor is direct-connected to the motor. All parts are easily accessible



Frame of the Oliver cake wrapping machine (right) is cast iron, but all parts coming in contact with cakes are either stainless steel, polished aluminum or nickel plated steel. Ball bearings are used almost exclusively. The infeed conveyor has chains on each side, connected by cross flights which hold cardboard for boxes. An automatic cutout stops the machine when wrapping material wrinkles or runs out



Features
Machines

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the Standpoint of Design

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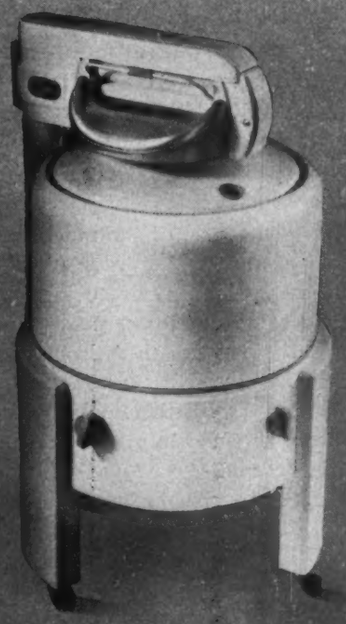


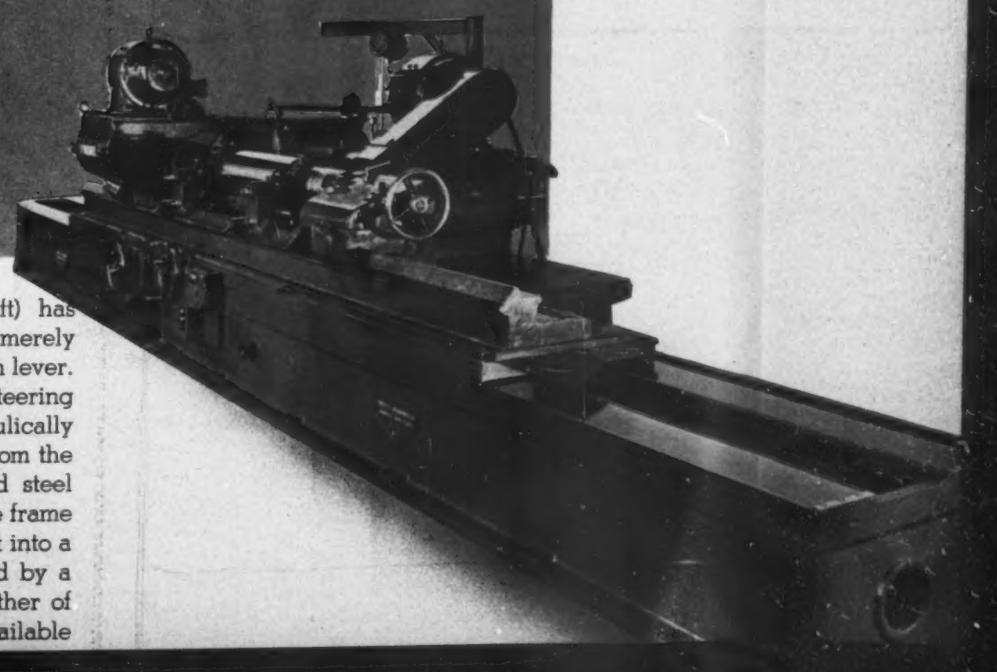
Levers have been elim nated in the Apex Speedliner washer (left) and rou d plastic turn-knobs for the gear control and drain have been substituted. Styled by Henry Dreyfuss, the machine is finished in white vitreous enam l. It has chromium plated drain boards. Chassis is electrically welded steel. Splash-proof motor drives intermittent type pump

OVER. Each of Missouri Pacific's is powered by two 1000-horsepower m a 1200-gallon fuel oil tank. The olution per minute, reach top speed nning speed is expected to be 110 ower in reserve. Each diesel has a or with a maximum output of 1000 speed. Six aluminum cars are in ere styled by Raymond Loewy

Operating automatically after being set for any work, the Farrel cylindrical grinder (below) incorporates a travelling work table and a fixed grinding wheel unit, and is equipped with a sensitive reversing mechanism permitting grinding up to the shoulder of the shaft. Seven motors are built-in, though eight are needed if a taper grinding mechanism is used. Beds are extremely heavy with deep sections well ribbed. Traveling table is alloy cast iron of high strength. Work table moves smoothly, driven from reversing motor through three gear trains

ecified for the housing of the cil sharpener (above). Drive o the shaft of the shaded pole tor. Cutters are high carbon pack-hardened and ground. aligning, oil-less and require ion only once a year

The Caterpillar diesel tractor (left) has "finger tip" steering, the operator merely pulling lightly on the steering clutch lever. This action opens a valve and the steering clutches are then operated hydraulically by a separate control unit driven from the upper transmission shaft. Welded steel construction is used extensively, the frame and steering clutch case being built into a one-piece unit. Power is furnished by a valve-in-head diesel engine and either of two five-speed transmissions are available



MACHINE DESIGN
Editorial

Machine Designer Plays Important Role in Consummation of Ideas

MANY brilliant mechanical ideas and inventions would be worthless but for the development of machines for bringing them to maturity. Often the creator of an idea—or in some cases a process—knows little of the intricacies of design or the problems involved. Here is where the design profession is able to step in and perform its most useful function—the development of equipment capable of production or performance whereby the idea can be brought to a commercially feasible conclusion.

Just such an opportunity occurred in the case of the machine discussed in the leading article in this issue. A "superfinishing" process was conceived that was calculated to surpass in smoothness and quality of surface anything that was available on a production basis. To carry out this process a machine with entirely new characteristics was essential. The success with which the designer of the machine solved the problems that were facing him can be judged readily from perusal of the article mentioned. Further, it can be seen how the machine, while being in the "revolutionary" class, is placed there primarily by outstanding ingenuity in the combination and use of well-known mechanical principles rather than by the employment of some hitherto unknown concept of design.

Which again proves that although the saying "There's nothing new under the sun" is a fallacy, "newness" in design chiefly depends upon the knowledge of the designer and his skill in utilizing time-proved movements and mechanisms combined with new materials, new parts and new processes. Also, that it is by such display of ingenuity that ideas sometimes considered impractical often can be developed successfully for the future widespread use of engineers and industry in general.

Drives and Controls

WE COULD have used any one of several types of drives but that one fits our requirements most advantageously . . . . " This is a chief engineer's typical reply when he is asked why a certain type of drive was selected. There are many reasons, of course, why one particular drive is best for a specific application. The same can be said for controls.

Recognizing the importance of the proper selection of drives and controls, MACHINE DESIGN will cover significant information on this phase of design in its annual supplement in the April issue. In the supplement will be found the reason why specific types of drives and controls serve a purpose more advantageously than others.

Professional Viewpoints

MACHINE DESIGN WELCOMES COMMENTS FROM READERS

" . . . . calculating flat springs"

To the Editor:

I READ with much interest the article in the November issue of MACHINE DESIGN, on the Use of Flat Springs. Could you tell me the chemical analysis and physical properties of these springs? Also, what thickness and width are generally used in the type of instrument shown in this article? How would you go about figuring the thickness and width of a joint that would carry, say, 500 to 1000 pounds? For instance, in *Fig.* 2, suppose *B* weighed that amount, would you use the customary column formula? The same question would arise in the joint, where the two springs make a cross. How do you drill holes in these hard springs?

—W. W. M.

To the Editor:

THE springs referred to were made of ordinary tempered clock spring steel of about 1 per cent carbon. The ultimate strength is around 220,000 pounds per square inch, but this probably varies with the thickness. The thickness of the various springs used in the extensometers varied from about .002 to .015 inch and the width from 1/9 to ½ inch. Holes were made in the springs by punching.

It seems to me that where the spring is rigidly clamped at both ends Euler's column formula could be used to find the buckling load, the proper end conditions for the column being assumed. Because of inaccuracies in the column formula (which is based on ideal conditions), a generous margin should, of course, be allowed between working load and calculated buckling load.

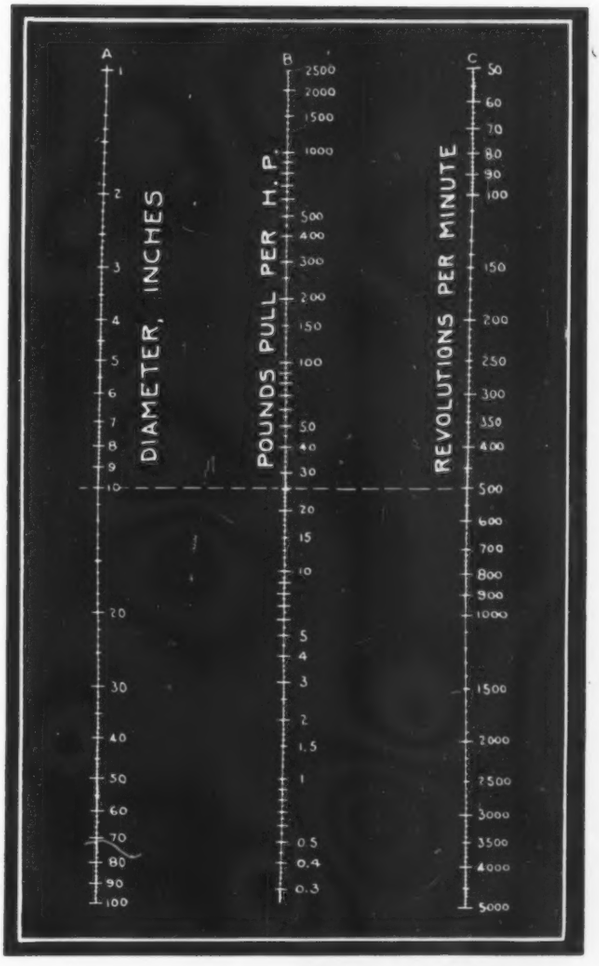
—A. M. WAHL
East Pittsburgh

" . . . aids in selecting drives"

To the Editor:

HERE is a handy chart which will quickly solve problems of selecting chains, belts and gears. For example, a chain is required for a 10-inch sprocket running at 500 revolutions per minute to transmit one horsepower. How strong must the chain be?

The dotted line drawn across the chart shows the answer. It is obtained by connecting the 10-inch point on column *A* with the 500 on column *C* with a straight line. Column *B* gives the answer as 25.2 pounds. If the



chain is to transmit 10 horsepower, multiply 25.2 by 10, which gives 252 pounds as the necessary strength.

It is necessary to multiply by whatever factor of safety is required for the problem. The figures in column *B* are for a factor of safety of one, or, in other words, no factor of safety at all. If a belt drive is being designed, the chart can be used in the same way for determining the "effective pull"—the difference in tension between the tight and the slack sides.

For gear drives the "push" may be found in a similar manner. In other words, if the diameter of the pitch circle is 10 inches and the gear is to make 500 revolutions per minute, the tooth must have a "pushing strength" of 25.2 pounds for each horsepower to be transmitted.

—W. F. SCHAPHORST
Newark, N. J.

Men of Machines

ANTHONY THEO LOGUS

WITH a background of many years of experience in original design and development of special machinery, Anthony Theo Logus is in an excellent position to fulfill his duties as engineer in charge of press design and development at Verson Allsteel Press Co., Chicago.

Mr. Logus was born in New York, and studied engineering at Columbia and New York universities. For five years he worked in the patent and research division of Bethlehem Steel Corp., developing special patentable steel and mining machinery. At A. O. Smith Corp. he was employed as designer and chief designer in the new projects division. Toward the end of his five-year connection with this company, he was personal engineer to the president. Then, as design and development engineer on large power presses, of all types, Mr. Logus was employed for three and one-half years by Hamilton Press Co.—his position before his present appointment.

JOHN DOLZA

CONNECTED with the Buick Motor division, Flint, Mich., since 1927, John Dolza has recently been assigned to design work on special projects for General Motors Corp. He formerly was assistant chief engineer of the Buick division.

Electrical, mechanical and aeronautical engineering training was obtained at the Polytechnical Institute of Turin, Italy. After graduation Mr. Dolza was in charge of the designing of aerodynamic equipment for the Aeronautical School of Turin, for four years. In March, 1926 he came to the United States and joined the staff of the Salesian School of New Rochelle, N. Y. Later during the same year he joined the New York Edison Co., New York, as draftsman. In 1927 he became associated with Buick Motor division, Flint, Mich., as body draftsman and since progressed rapidly through the following capacities: engine draftsman, assistant engineer, research engineer, engine designer and chassis designer.

DONALD W. DOUGLAS

IN RECOGNITION of his "outstanding contributions to the design and construction of transport planes," Donald W. Douglas, president of Douglas Aircraft Co., Santa Monica, has received the Daniel Guggenheim medal for 1939, awarded by the Institute of Aeronautical Sciences.

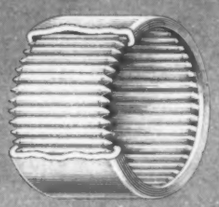
In 1912 Mr. Douglas resigned from the Navy and entered Massachusetts Institute of Technology, preferring "wings and skies" to the "seven seas." Progressing rapidly at the institute, he was graduated in two years and in June of the same year received his first job in aviation —as assistant in aeronautical engineering at the institute. While there, he assisted in work on the first wind tunnel. The following year he joined the Connecticut Aircraft Co., where he worked on the D-1, the first dirigible built for the U. S. Navy.

He then became chief engineer for Glenn L. Martin and the next

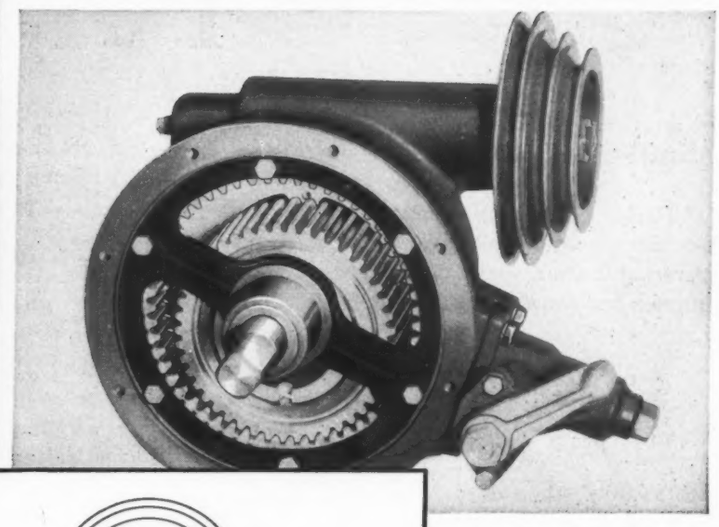
(*Concluded on Page* 102)

WINKLER STOKERS

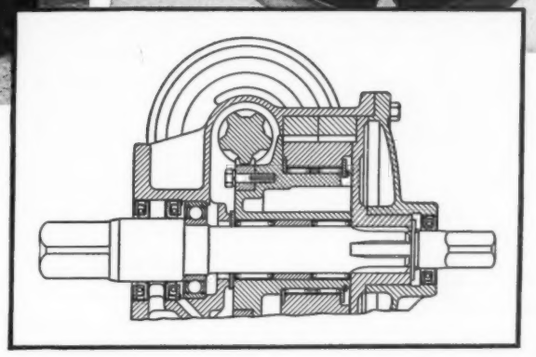
USE TORRINGTON NEEDLE BEARINGS FOR HIGH CAPACITY IN SMALL SPACE



Winkler Stokers are built throughout for lasting service under severe conditions.



(*Above*) Heart of the stoker is the Winkler Automatic Transmission, in which Torrington Needle Bearings are used under heavy loading conditions.



(*Left*) Cross-section view of the transmission. Design requires extremely high speed reduction ratio.

UNUSUALLY high bearing loads—an extremely large speed reduction ratio—these are inherent problems in the design of stoker transmissions. And U. S. Machine Corporation, manufacturer of the powerful, rugged Winkler Stoker, solved them by using the Torrington Needle Bearing on its exclusive "INTER-PLAN" drive.

"The advantages of the Needle Bearing, with its tremendous load carrying capacities and very minimum of diametral requirements, make this type of bearing ideally adapted in the Winkler Stoker Drive," says Herman Winkler, Chief Engineer of U. S. Machine Corporation. "The ease with which lubrication problems may be handled with Needle Bearings also contributed substantially to the reasons for their selection in the 'INTER-PLAN' drive."

To test the performance of Winkler Stokers, a stoker transmission was run *continuously* for a full year, carrying a Prony brake load of *600% above normal* —the equivalent of 30 years' operation under ordinary conditions. At the end of the test, there was no noticeable wear *on a single part*—convincing evidence of long life of the Torrington Needle Bearing under severe loads.

Perhaps you, too, can profitably employ these advantages of this Needle Bearing in your own product. Let the Torrington Engineering Department show you how you can avail yourself of the bearing's high capacity, small size, ease of lubrication. For further information, write for Catalog No. 9. For Needle Bearings to be used in heavier service, request Booklet No. 103X from our associate, Bantam Bearings Corporation, South Bend, Indiana.

The Torrington Company
ESTABLISHED 1866
Torrington, Conn., U.S.A.

Makers of Ball and Needle Bearings

New York Boston Philadelphia Detroit
Cleveland Chicago London, England

TORRINGTON
NEEDLE BEARING

Noteworthy PATENTS

Endless Conveyor Pumps Concrete

UTILIZING folding impellers on the pump rotor, the concrete pump shown in *Fig.* 1 is capable of delivering a continuous, nonpulsating flow. Its construction and provisions for flexibility make it possible

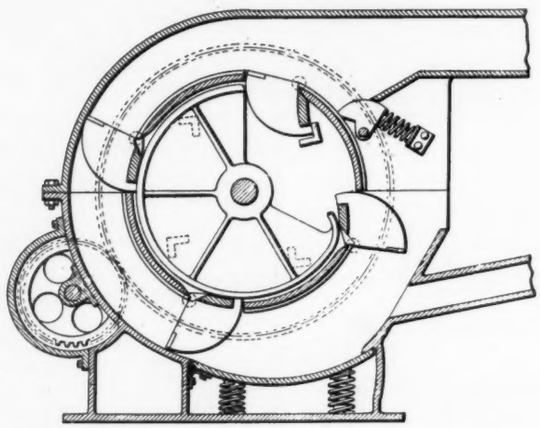


Fig. 1—Impellors ride on stationary cam to force concrete through pump with nonpulsating flow

to handle concrete without clogging or imposing undue strain on the pumping elements.

Concrete is fed into the lower chamber and carried through the chamber by the impellers traveling around a stationary cam. If too much concrete is picked up, or if a piece of aggregate in the mix should interfere, a spring supported plate will relieve the congestion. Each impeller rides on the cylindrical portion of the cam until it reaches a position over a cut out portion at which place it drops by gravity under a spring supported sealing element. If it should not drop by gravity, this element will move it to its retracted position as it passes.

On further motion the impeller meets the in-curved portion of the cam and is forced outwardly to drive another quantity of concrete into the pumping chamber. The sealing element checks the back flow of concrete and, acting as a scraper, keeps the rotor clear of adhering particles. This pump was designed by Howard Staten Murray and is assigned to Uniflow Pump Co.

Simple Design for Centrifugal Switch

HIGHLY efficient and economical in construction, this centrifugal switch design, covered by patent 2,182,977, is useful for applications requiring the closing or opening of contacts such as used for controlling the starting current of an electric motor. Illustrated schematically in *Fig.* 2, this switch is extremely simple in operation.

Depending on the balance between a weight and spring holding this weight against the rotor shaft, the switch operates when the centrifugal force acting on this weight exceeds the spring force. Operation is with snap action in both directions. When switch is closed as for starting current, the spring actions on the contact arm hold the contacts in good electrical engagement. When rotation reaches the speed at which switch overbalances its spring, the weight moves outwardly and cause the switch to operate with snap action opening the starting circuit.

Similar action takes place when the speed decreases to cause the switch to close again with a quick action. Designed by Calvin J. Werner, the switch is assigned to General Motors Corp.

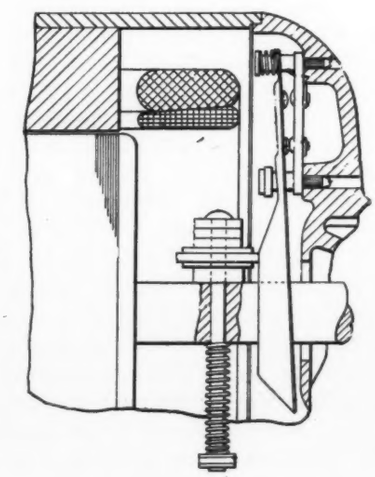


Fig. 2—Snap action centrifugal switch depends on action of single weight and spring for operation

Announcement

Great Importance

Small Group of Designers

HERE'S HOW WE BUILD THE VALV-AMP ROTOR

First of all, it has no built-in "gadgets." The laminations are formed and assembled so as to break up the axial continuity of the necks connecting the inner and outer squirrel cages. Thus at starting, the flow of current is confined to the outer squirrel cage. When the motor reaches full-load speed, the rotor frequency is low and current flows in the entire rotor conductor. Typical slots have oblique instead of radial necks. This construction gives you for the first time motors up to 100 hp with an indestructible, cast-aluminum, double-squirrel-cage rotor.

APPLICATIONS OF MOTORS WITH VALV-AMP ROTORS

Motors with the Valv-amp rotor construction are excellent for applications where high starting torque and low starting current are required—such as driving air-conditioning and commercial-refrigeration compressors, loaded conveyors, and ball mills. Don't delay getting further information about this important development. Call or write the nearest G-E sales office today. Or send the coupon direct to General Electric Company, Schenectady, N. Y.

General Electric, Section B-020-902
Schenectady, N. Y.

Gentlemen:

I am very much interested in your development, the Valv-amp rotor. Please send me more information.

Name .....

Firm .....

Address .....

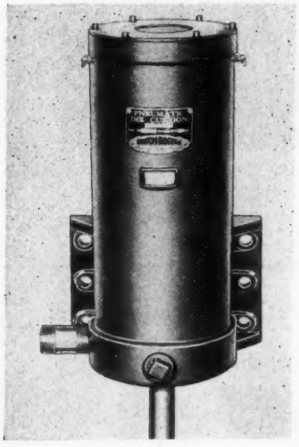
.....

GENERAL ELECTRIC

New PARTS AND MATERIALS

Air Cylinders Counter-Balanced

A NEW design of pneumatic slide counter-balanced cylinders, primarily intended for large presses with long stroke, is announced by the Dayton Rogers Mfg. Co., Minneapolis. These counter-balanced cylinders are chiefly designed to offset the over-riding or falling of the ram during the press cycle and can be used singly or in combination. Common applications include two to four cylinders on each press. Depending upon press requirements, these cylinders are made in diameters from 6 to 14 inches and strokes from 10 to 30 inches. Each set of cylinders has a pneumatic regulator and gage, together with surge tank equipment and the regulator and gage are so arranged that the pressure may be increased or decreased on the cylinder piston, compensating for light or heavy slides.



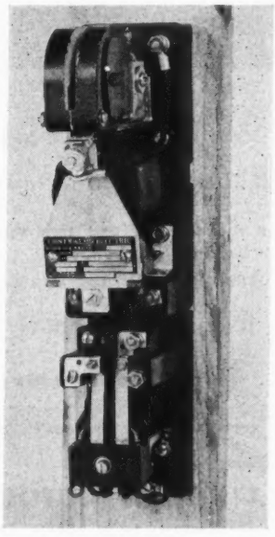
Counter - balanced cylinders are chiefly designed to offset the over-riding of the ram during the cycle of large long-stroke presses

Resistant Welding Rod Announced

A NEW alloy welding rod for hard-surfacing wearing parts, Haynes "93" has been announced by Haynes Stellite Co., unit of Union Carbide & Carbon Corp., New York. It is recommended for use where severe abrasion, accompanied by only a moderate amount of impact, is encountered. The new rod does not possess as high wear resistance as Haystellite cast tungsten carbide products or Haynes Stellite alloys, but it is more wear-resistant than Hascrome hard-facing alloy. It is not as tough as the latter, however. Haynes "93" is of ferrous composition and contains chromium, molybdenum, cobalt and other alloying elements to the extent of more than 40 per cent. It has a tensile strength of about 43,000 pounds per square inch and a hardness, as deposited by oxyacetylene welding, of 62 Rockwell C. When deposits are heat treated to 1950 degrees Fahr. and then air cooled, the hardness reaches 66 to 67 Rockwell C.

Develop Relay for Circuit Breakers

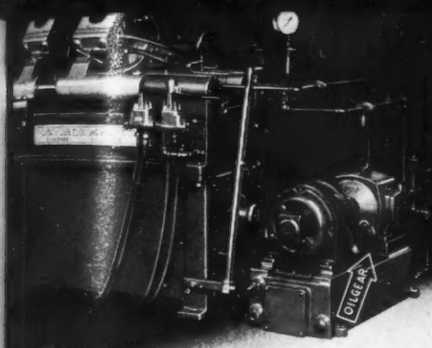
FOR oil circuit breakers equipped with cut-off switches, General Electric Co., Schenectady, has developed the type HKA pump-free control relay, consisting of two elements, an operating and an auxiliary element. The former picks up and closes its main contacts for the closing solenoid and at the same time seals itself in. The auxiliary element is energized by a solenoid cut-off switch closed by the operation of the solenoid mechanism. One set of contacts opens the main-element coil circuit and thus de-energizes the solenoid closing coil. A second set of contacts closes to seal in the auxiliary element around the cut-off switch so that if the control switch is held closed, there can be no further breaker closures until the control switch contacts open to allow the auxiliary element to reset.



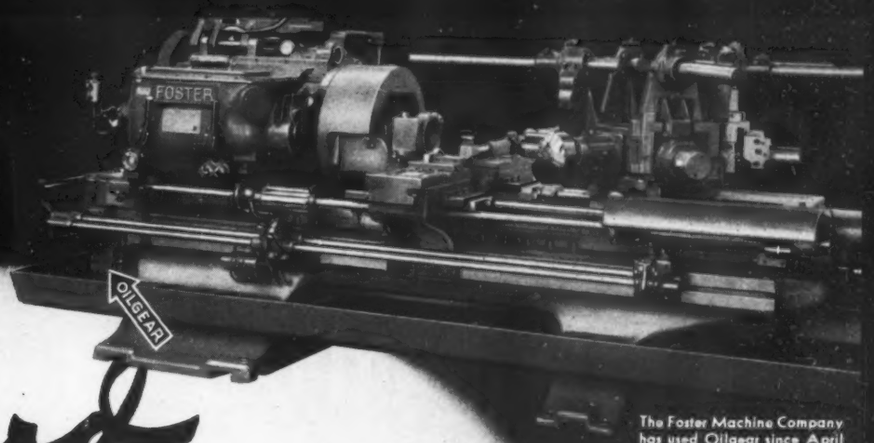
Two elements, an operating and an auxiliary, are included in newly announced pump-free control relay

Vernier Controls Speed Changes

FOR installations where extremely fine control of speed changes is required, vernier control is being offered by Link-Belt Co., Chicago, for all sizes of the P.I.V. gear variable speed transmission. This vernier control can be supplied with either one of two ratios, 7½ to 1 or 30 to 1 and is equipped with two handwheels. One is for direct control; the secondary or vernier handwheel will provide either 30 turns or 7½ turns to one of the direct wheel. Services for which this control is especially suitable include synchronizing



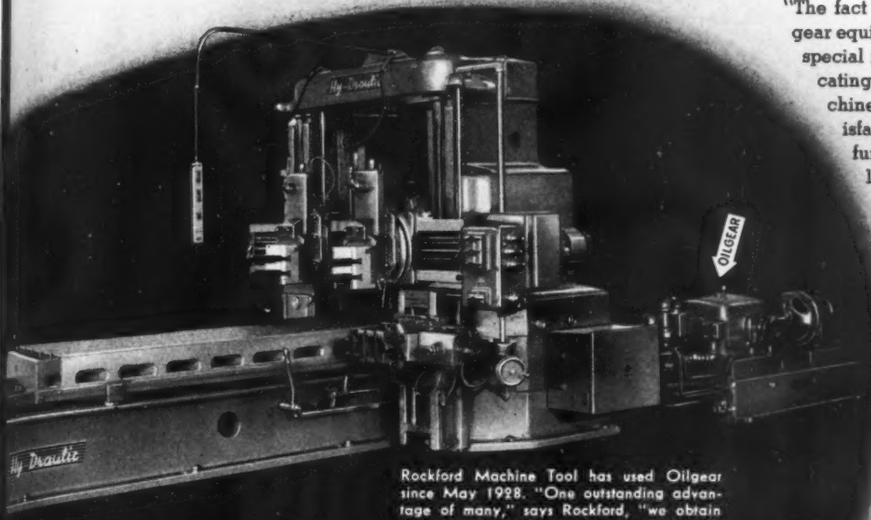
Thompson-Gibbs have used Oilgear extensively on their welders since 1923, to provide greater convenience, more accurate control and other advantages.



The Foster Machine Company has used Oilgear since April 1923. L. D. Tyson, chief engineer, says: "Oilgear reduces cost and presents increased production. It removes limitations, provides compactness and other advantages."

"USED AS *Standard* EQUIPMENT FOR 14 YEARS"

A TIP TO MANUFACTURERS OF MACHINES AND MACHINE TOOLS



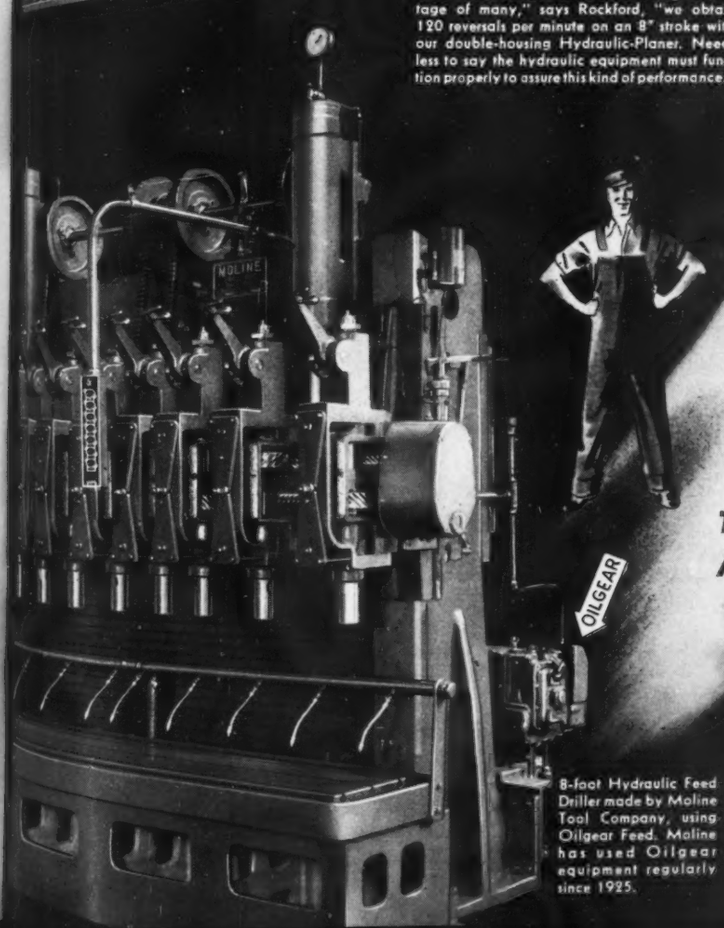
Rockford Machine Tool has used Oilgear since May 1928. "One outstanding advantage of many," says Rockford, "we obtain 120 reversals per minute on an 8" stroke with our double-housing Hydraulic-Planer. Needless to say the hydraulic equipment must function properly to assure this kind of performance."

"The fact that since 1925 we have used Oilgear equipment for feed on drilling, boring and special milling machines, and for the reciprocating action of multiple spindle honing machines, should be ample evidence of our satisfaction with the equipment and service furnished by Oilgear. At no time in the last 14 years have we had any complaint from our customers in regard to Oilgear equipment."

So writes the Moline Tool Company . . . and in doing so they speak for many other leading manufacturers who have standardized on Oilgear Fluid Power Pumps and Motors for periods ranging from 10 to 17 years. One manufacturer has applied Oilgear Power to 1700 units.

Oilgear units give trouble-free service, but in addition they permit speeds, operating control and convenience, flexibility of application and many other advantages to a degree unequalled. *This is a matter of factual record.*

You are invited to send for the 64-page Handbook on Oilgear Pumps and Motors. Use the handy coupon TODAY. THE OILGEAR COMPANY, 1310 W. Bruce Street, Milwaukee, Wisconsin.



8-foot Hydraulic Feed Driller made by Moline Tool Company, using Oilgear Feed. Moline has used Oilgear equipment regularly since 1925.

OILGEAR
Trademark
Reg. U. S. Pat. Off.

OILG

THE MOST EFFECTIVE APPLICATION OF fluid power

The Oilgear Company, 1310 W. Bruce Street, Milwaukee, Wis.
Please send me a copy of Bulletin 47000 without obligation.

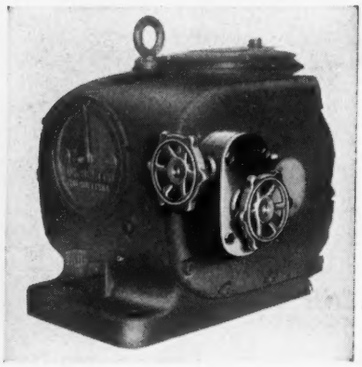
Name .....

Company .....

Address .....

City ..... *State* .....

speeds of two machines; justifying for shrinkage and expansion of such products as textiles and paper; controlling feeders; weighing operations; obtaining exact

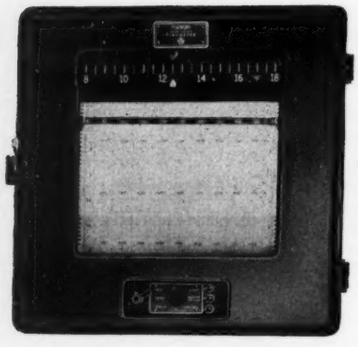


For all sizes of the P. I. V. variable speed transmission, vernier control is being offered

register; controlling the overlay of wire-covering on wire producing machinery.

Controllers Have Unusual Features

INCORPORATING three features said to be unique in instruments of this kind, the Foxboro Co., Foxboro, Mass., has announced a series of potentiometer recording controllers. These features are an improved detecting mechanism, a new integral recording and control mechanism and a control system providing maximum flexibility of use. Open-and-shut action or throttling action, with or without automatic reset, is available in the air-operated models of the new series. To obtain a more sensitive detecting mechanism than that

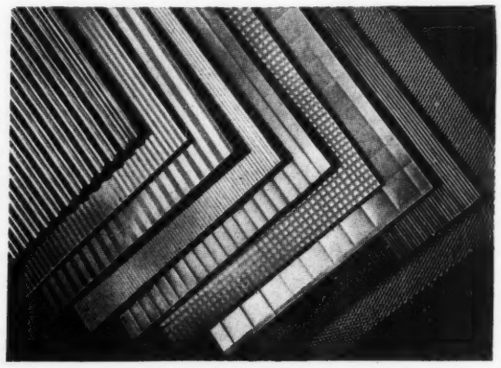


Features of new recording controllers include an improved detecting system, integral recording and control mechanism and flexible control system

required for recording, a single calibrated detecting cam is used which will sense deflections of the galvanometer pointer of less than .0001-inch without lost motion. By positioning a friction roller, the cam positively determines the movement of the integral slidewire contact, recording and control actuating carriage. The new controller is highly accessible. The entire mechanism can be pulled forward out of the case and every moving part can be removed or replaced.

Bond Nickel, Chromium to Aluminum

TWO prefinished bonded metals have been placed on the market for the first time by American Nickeloid Co., Peru, Ill. The metals are nickel aluminum and chromium aluminum and are said to combine the beauty, tarnish-resistant qualities and durability of nickel and chromium with the lightness, strength and workability of aluminum. A surface of chromium or nickel is bonded by an electrolytic process to an aluminum base and can be soldered with 50-50 solder and regular cut-acid. The bond developed does not peel, lift, or chip



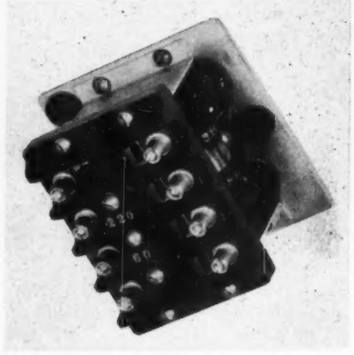
Nickel and chromium are bonded electrically to an aluminum base to form two new prefinished bonded metals

and the metals will withstand temperatures of 500 to 750 degrees Fahr. without discoloration of surface and without excessive warping. Some of the patterns available are shown in the illustration and are available in sheets up to 36 x 96 inches in a full range of tempers and in gages from .01 to .064-inch.

Small Contactor Has Large Capacity

TO MEET demand for a small compact contactor of large horsepower capacity, the series B automatic contactor is announced by Bender Warrick Corp., Birmingham, Mich. Movable parts of the contactor travel on a unique involute gear tooth bearing which always allows these parts to travel on the same plane. This

Movable parts of small contactor travel on a unique involute gear tooth bearing which always allows these parts to travel on the same plane



bearing and all other parts which might wear are hardened, so that the mechanical life of the contactor is greatly lengthened. Spring pressures on the movable contacts are greater than usual and this feature assures better current carrying characteristics and a quicker break of arcs.

Lubricators Independent of Drive

AUTOMATIC lubricators with no mechanical drive connection between the machine and lubricator pump are announced by Bijur Lubricating Corp., Long Island City, N. Y. In place of the driving mechanism,

"FASTENING HEADQUARTERS"

Invites you to test these better fastenings!

FREE SAMPLE KIT OF SHAKEPROOF PRODUCTS

Send for this free sample kit today!

Each Shakeproof fastening presents to metal product manufacturers a definite opportunity to improve performance and reduce production costs. Shakeproof engineers have developed and proven these fastenings in their effort to improve metal fastening methods. If you have a fastening problem or a fastening product that requires development, write to "Fastening Headquarters!"

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"Fastening SHAKEPROOF Headquarters"

SEMS Fastening Units . . . Lock Washers . . . Locking and Plain Terminals

Thread-Cutting Screws . . . Locking Screws . . . Spring Washers . . . Special Stampings

Expensive Slip Ring Motors are NOT the Only Answer to Variable Speed Drives

HOWELL Multi-Speeds are O. K. for Many Such Jobs — and You Save Plenty!

MULTI-SPEED MOTOR

Wherever possible use HOWELL Multi-speed Motors — and you have far cheaper, more efficient, more satisfactory drives.

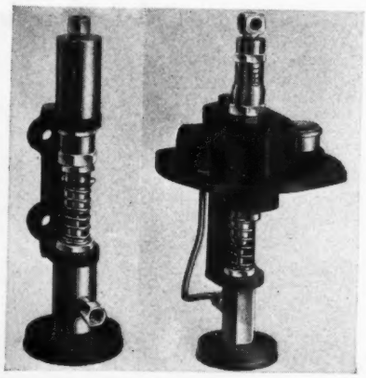
The HOWELL Multi-speed Motor is in reality a series of single speed motors enclosed in one housing — very compact. These units are built for 2, 3 and 4-speed operation, both open and enclosed types in sizes ½ to 150 H.P. Speed changes can be manually or automatically obtained. Motors can be wound for constant or variable horsepower; constant or variable torque.

Here are ideal motors for operating machine tools, pumps, blowers, conveyors and many other machines. If you have variable speed drive problems, it will pay you to consult with us.

1915 · 1940 HOWELL MOTORS 25th Anniversary Year

HOWELL ELECTRIC MOTORS COMPANY
HOWELL, MICHIGAN
Representatives In All Principal Cities

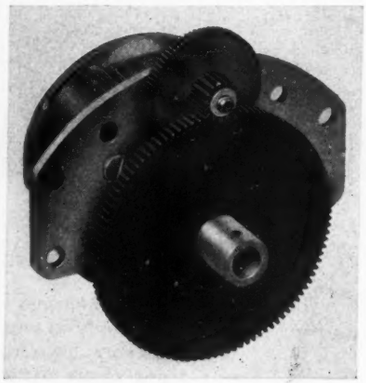
a small diameter tube is connected between the machine's hydraulic system and the pump used for feeding oil to the various bearings. Maximum flexibility in design is made possible by this method since the pump can be located at the most convenient point, independent of any consideration as regards drive. The hydraulic lubricator pumps illustrated are of two distinct forms: Type C, arranged for mounting on a standard two- or six-pint oil reservoir; and type G, particularly adapted to mounting in a reservoir cast integral with the machine.



Flexibility in design is made possible with automatic lubricators which have no mechanical drive connection between the machine and lubricator pump

Develop Gear Reductions for Motors

A LINE of open type gear reductions for YAr size motors is announced by Barber-Colman Co., Rockford, Ill. Three gear ratios are supplied for these motors, providing output shaft speeds of 80, 54 and 11 revolutions per minute. Cut spur gears are used in these reductions, a textolite gear being provided on the first step to reduce noise to a minimum. Steel gears are cadmium plated for corrosion resistance and the gear studs and output shaft are nitrided to secure a hard noncorrosive bearing surface. The rotor shaft is hardened stainless steel. Brass is used for the gear plate which has holes for mounting to a suitable bracket.



Cut spur gears are used in a line of open type gear reductions announced for YAr size motors

Method Bonds Rubber to Steel

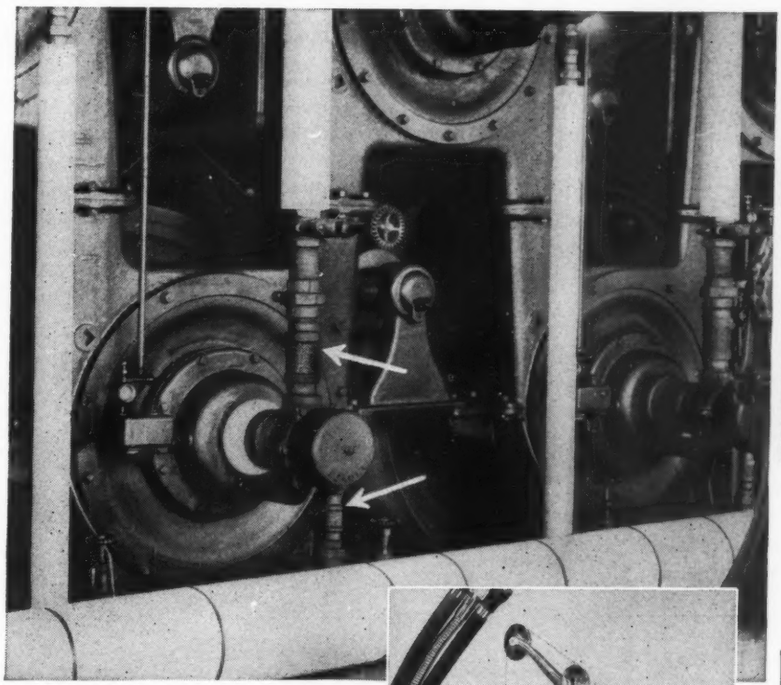
A METHOD for bonding soft rubber and neoprene to steel and aluminum by hot vulcanization has been announced by Hewitt Rubber Corp., Buffalo, N. Y.

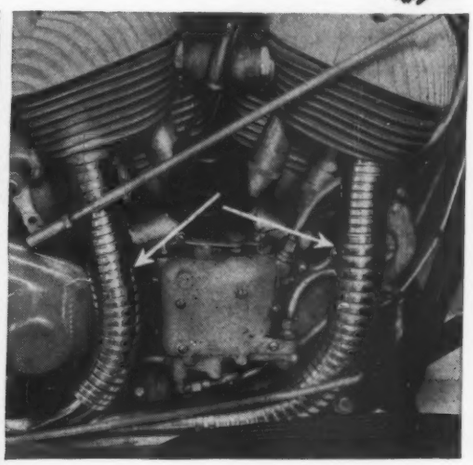
"I used American Seamless"

SOLVED! 3 DISTINCTLY DIFFERENT CONNECTOR PROBLEMS

"Metal Hose did the trick for me"

"I used both in my design"



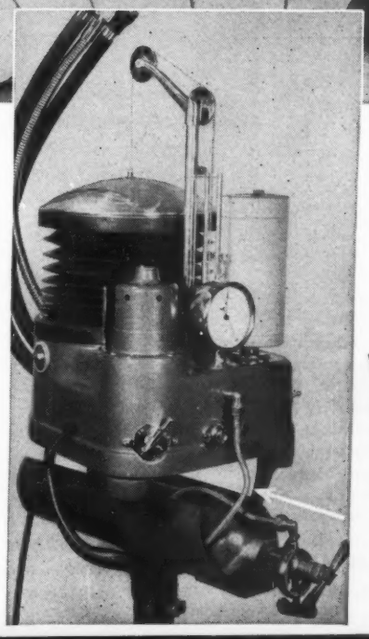


In seeking to prevent exposed exhaust pipes from disturbing the smooth, streamlined appearance of this Indian motorcycle, the designer found a wholly satisfactory solution in American Flexible Metal Tubing. This picture is adequate proof of that.

The designer of this 213" Beloit Kraft Machine knew that vibration and expansion in pressure steam lines were frequently the cause of pipe failures. So, to end these costly failures he specified short lengths of American Seamless flexible metal tubing at the points indicated in this picture. The additional cost for this precaution was negligible; the saving appreciable.

•

Safety and utility were requirements for connections in this metabolism testing apparatus. And American solved each need with the right material. In the lower right, American Seamless safeguards the conveyance of gas under pressure and provides a simple method of connecting and disconnecting the gas cylinder.



These and hundreds of other design problems involving flexible connectors for the conveyance of steam, air, oil and other liquids and gases have been solved by the products of American Metal Hose. The book illustrated here will bring you complete and detailed information on American Seamless, the most dependable flexible tubing that you can specify.

•

Write for this new 24-page manual on American Seamless Flexible Metal Tubing. Contains more than 75 pictures and charts explaining applications and availability. 40244

American Metal Hose

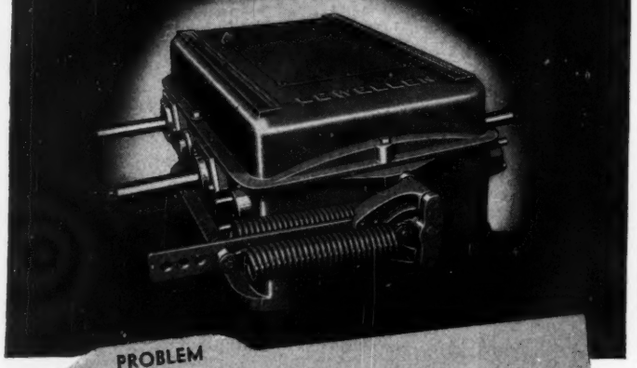
ANACONDA

AMERICAN METAL HOSE BRANCH of THE AMERICAN BRASS COMPANY

General Offices: Waterbury, Conn. • Subsidiary of Anaconda Copper Mining Company

In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

SPEED CONTROL
at its best



PROBLEM

The Case of an Important Safety Control on Stoker Drives

from the files of Lewellen Engineers

● On stoker drives, any overtravel or rapid movement of the controlling device causes excessively rapid changes in the firing rate and corresponding accelerating loads to the stoker.

SOLUTION: *A specially designed Safety Lever to operate the Lewellen Transmission. While the lever follows any rapid motion of the controlling device, speeds are adjusted only at a safe, controlled rate of acceleration.*

RESULT: *A positive safety feature!* Should the control lever move suddenly, the speed is changed gradually by the action of the springs—the speed always coming to the speed corresponding with the position of the control which operates this safety device on the Lewellen Transmission. The controller operated from the steam pressure may move 90° without damage to the transmission.

YOU MAY BE directly interested in our solution of this problem. Hundreds of companies will profit by it. Here's our purpose, however, in bringing it to your attention. *We want to apply the same experience to your problem that we used in tackling the one mentioned above. We want to show you how your production machines may be controlled profitably by the proper application of Lewellen speed control.* Our engineers are constantly working with companies in order to solve their particular speed control problems. This is our specialty. It has been for more than 40 years. Think of the dollar saving in operating your machines at the correct speed!

—Why not call a Lewellen representative today?

LEWELLEN MANUFACTURING COMPANY, COLUMBUS, INDIANA

Lewellen

Variable Speed { TRANSMISSIONS MOTOR PULLEYS

★ Lewellen knows speed control

The process results in exceptionally high adhesion strength between the rubber and the metal and the bond has remarkably good aging qualities. By a special chemical treatment the composition of the rubber is modified in such a manner that it attaches itself integrally to the metal and still retains its capacity to vulcanize itself to the outer rubber layer. This process is called Dura-Bond. At present recommendations for heat conditions under which the process may be employed are limited to 200 degrees Fahr.

Photoelectric Relay Announced

A NEW compact photoelectric relay has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh and is designated the type RQ Photo-Troller. It is specially made for low operating expense and ease of installation and has two normally open and two normally closed contacts, each rated at

Low operating expense and ease of installation are two features of photoelectric relay

10 amperes on 115-volt alternating current circuits. Increased sensitivity is obtainable by means of a condensing lens. The unit has a gray die-cast chassis with a block molded cover removable without tools.

Weld Time Controlled to Half Cycle

ABILITY to control welding time to a half cycle of current on any resistance welder is provided by a new weld timer announced by Weltronic Corp., 2832 East Grand boulevard, Detroit. The timer is recommended particularly for welding thin section stainless

Recommended for welding thin section stainless steel, aluminum and similar metals, weld timer controls welding time to a half cycle

steel, aluminum, brass screen, copper lugs and similar applications where unusually high heat and close control of welding time is essential. Known as model

AMAZING G-E KON-NEC-TORS

...HELP RING CHURCH BELLS, METER MAIL...MOVE MOUNTAINS, AND CONTROL COLOR PATTERNS...

G-E KON-NEC-TORS are used to ring the largest bells in the carillon tower in one of the nations leading churches, and also for ringing the quarterly-hour chimes. Contacts are always clean, maintenance eliminated.

A MANUFACTURER of postage metering machines found that KON-NEC-TOR mercury contacts were foolproof even after four years of hard service. Despite the rapidity of cancellations, the electric circuits broke fast and clean.

FOUR G-E KON-NEC-TORS are nerve centers in the patented leveling system controlling hydraulic jacks that provide this 1250-ton Bucyrus-Erie stripper with an electrical balancing equipment.

THE ELECTRICAL CURRENTS that control the color patterns on this floor covering printing machine are made and broken by twenty-five KON-NEC-TORS, operating fast and dependably.

WHEREVER electrical equipment circuits are made and broken, G-E KON-NEC-TORS provide wear-proof, trouble-free, and maintenance-free contacts. For these modern mercury switches, adaptable to the design of all kinds of electrical machinery, are safe, dependable, and long-lived contact devices. Because of their patented construction, KON-NEC-TORS may be operated *millions of times* with unvarying efficiency.

Thousands of KON-NEC-TORS are in use daily . . . providing clean, positive make-and-break for the electrical circuits that control the operation of a multitude of machines as diverse in their functions as coin-operated cameras and steam pressure controllers.

Whatever your needs may be, there's a right size and type of G-E KON-NEC-TOR for the job. For complete details, fill in the coupon below.

NELA SPECIALTY DIVISION, LAMP DEPARTMENT

GENERAL ELECTRIC

414 Eighth St., Hoboken, N. J.

VALUABLE FREE BOOKLET GIVES COMPLETE SPECIFICATIONS AND DESCRIPTION!

Nela Specialty Division, Lamp Dep't. MD-B
General Electric Company,
414 Eighth St., Hoboken, N. J.

Please send me a free copy of your booklet "KON-NEC-TOR . . . the simple, switching device."

Name.....

Company.....

Street.....*State*.....

Since its founding in 1915, a young concern in an old business, The Ohio Gear Company has tried, consistently, to hold fast to its young ideas of the quality of product and the kind of service Gear Users want.

The ever-growing number of nationally known Gear Users who depend on Ohio for their requirements confirms the soundness of these ideas.

And the dawn of its 25th year of continuous service sees the Company looking, not back over past successes, but forward toward new opportunities for serving your requirements for Gears, Sprockets, Chain, Speed Reducers and all types of Power Transmission Equipment.

Our Catalog gives you a comprehensive idea of our service. Write for one now.

THE OHIO GEAR CO.

1338 E. 179th Street • Cleveland, Ohio

Representatives

*NEW YORK CITY, N. Y.
Patron Transmission Co.,
154-156 Grand Street

*LOS ANGELES, CALIF.
J. W. Minder Chain & Gear Co.
927 Santa Fe Avenue

GRAND RAPIDS, MICH.
W. H. Slaughter,
419 Oakdale St., S. E.

*PITTSBURGH, PA.
Standard Machinists Supply Co.
South 2nd and McKean Street

DETROIT, MICH.
George P. Coulter
322 Curtiss Building

BUFFALO, N. Y.
F. E. Allen, 2665 Main St.

*KANSAS CITY, MO.
Kansas City Rubber & Belting Co.
712 Delaware Street

*SAN FRANCISCO, CALIF.
Adam-Hill Co.
244-246 Ninth St.

NEW ENGLAND George G. Pragst
260 Esten Ave., Pawtucket, R. I.

LOUISVILLE, KY.
Alfred Halliday, 330 Starks Bldg.

*INDIANAPOLIS, IND.
A. R. Young
518 North Delaware Street

ST. LOUIS, MO.
St. Louis Tool Co.,
2319 N. Ninth Street

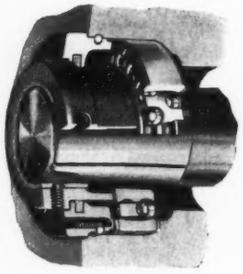
*Stocks carried.

OHIO GEARS

90-1, the timer is available in 220 to 550 voltages with frequencies of 25, 50 and 60 cycles. Amperage range of 150 to 600 is also available. The new unit consists essentially of only two moving parts, the relays, in addition to one electronic and one rectifier tube.

Built-in Ball Bearings Facilitated

TO PROVIDE a simple means of incorporating ball bearings in machines where the bearing housing is an integral part, Ahlberg Bearing Co., 3053 West Forty-seventh street, Chicago, has developed a line of bearing units known as CJB simplex machine units. They are available in three capacities for light, medium and heavy loads, with either single or double row or self-aligning bearings. In the light series the bearings are



Ball bearing units for machines where the bearing housing is an integral part are available in three capacities

mounted directly on the shaft; the medium and heavy units mount through a split adapter sleeve in a tapered bore bearing. A new type labyrinth seal has been developed, using neoprene as the sealing material. Retaining caps are optional either in the open type as illustrated or the closed type, the latter sealing the bearing completely.

Connection Eliminates Tube Fatigue

A SYSTEM of flexible connection for copper, aluminum and steel tubing which provides a positive safeguard against vibratory action, protecting against tube fatigue by absorbing vibratory strains, is announced by VibraSeal Corp., 2832 East Grand boulevard, Detroit. The fittings consist of an adapter body seated to receive a gasket which is swaged

Vibratory strains are absorbed by system of connection

into the tubing by the compression of a locknut. When the fitting is assembled in place a flexible seat is formed which permits tubing to flex in a movement of several degrees, cushioning vibration at a vital point and eliminating causes of breakage.

Low-Bake Industrial Finish

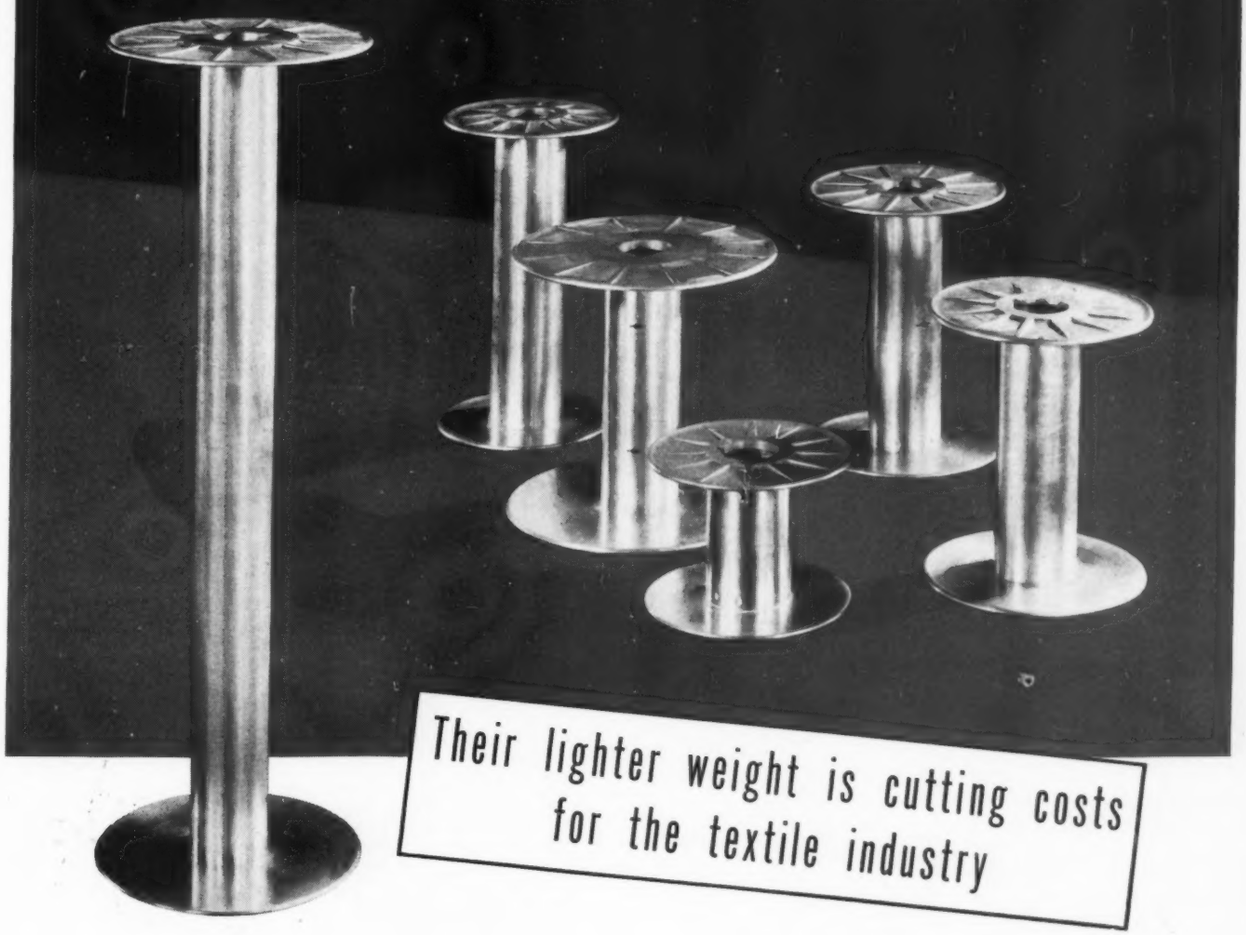
CALLED Polymerin-100, a new industrial finish with exceptionally low-temperature speed baking characteristics is announced by Ault & Wiborg Corp., New York. It makes possible curing temperatures often

(*Continued on Page* 76)

MAZLO
Reg.U.S.Pat.Off.

MAGNESIUM ALLOYS

THE LAST WORD IN LIGHTNESS



Their lighter weight is cutting costs for the textile industry

These "warp beams" are very light in weight. They're made of MAZLO Magnesium, which weighs only one-fourth as much as iron. The flanges, permanent mold castings, are spot welded to extruded tubing. Thousands of these warp beams are in service, proving Magnesium's ability to "take it."

Light weight is important here, because warp beams often travel back and forth, repeatedly, between plants many miles apart. Think what this lighter weight saves on transportation costs! And there's less fatigue for mill workers; improved machine operation.

In *your* products, the lighter weight of MAZLO Magnesium Alloys may be similarly, advantageously employed. Or for reducing the inertia of moving parts. MAZLO manufacturing facilities make them available to you in every form: sand castings, permanent mold and die castings, extruded bar and shapes, sheet, tubing and forgings. MAZLO engineers will assist you on problems of going *very* light economically. *Sales Agent:* Aluminum Company of America, 1703 Gulf Bldg., Pittsburgh, Pa.

MAZLO

AMERICAN MAGNESIUM CORPORATION

Archimedes and the Spiral Pump

ARCHIMEDES*

. . . . . *used them too!*

As far back as the second century B. C., when Archimedes discovered the principle of the spiral pump, machine drives and controls were used . . . true the drives were manpower and controls were the result of the spoken word . . . but, machine drives and controls are as old as machinery itself.

The Machine Drives and Controls Supplement

MACHINE DESIGN for April will contain the Fourth Annual "Machine Drives and Controls" Supplement. Within its covers will be a comprehensive summary of all that is new in machine drives and controls during the past year . . . including new applications, recently devised uses for standard equipment, and new developments in the field of machinery control and drives.

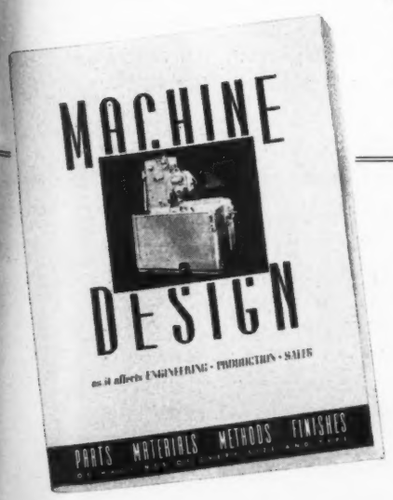
MACHINE DESIGN's Supplement will be the only place where all this information can be reviewed in a compact, concise, easy-to-get-at manner.

For a factual resume of "Machine Drives and Controls" progress during the past year, look for, and plan to file for easy reference, MACHINE DESIGN's April issue, or its removable, filable supplement.

Contents Will Include Discussions Of:

Built-in Motors . . . Gear and Special Motors
Electric Motors of All Types . . . Chain Drives
Variable Speed Drives...Gears and Gear Boxes
V-Belt, Cotton Belt and Leather Belt Drives
Air Cylinders and Valves . . . Magnetic Drives
Floating Motor Bases . . . Switches of All Types
Solenoids . . . Motor Circuit Breakers...Timers
Rheostats . . . Hydraulic Cylinders and Valves
Photoelectric and Other Vacuum Tubes...Relays
Controllers . . . Internal Combustion Engines
Hydraulic Transmissions

. . . and comprehensive discussions of their applications and combinations, written for the benefit of chief engineers and designers who select and specify machine drives and controls in the design of machinery.



* Like Archimedes, advertisers in the April "Machine Drives and Controls" Supplement, can discover something that may be new to them . . . the vast market for these parts that is controlled by chief engineers and designers—the *original specifiers* of parts, materials, methods and finishes. Advertisements in the Supplement will be effective for a full year. Reservations should be made as soon as possible. Forms close March 9.

MACHINE DESIGN

A Penton Publication

110 E. 42nd Street NEW YORK | Penton Building CLEVELAND | 520 N. Michigan Ave. CHICAGO

SOLVED THE G-E WAY

PARTS: Textolite molded-laminated cams. **USE OF PARTS:** Used as the cam mechanism in the new shoe stitching machines manufactured by the United Shoe Machinery Corp., Beverly, Massachusetts. **CUSTOMER'S PROBLEM:** United Shoe needed a material to replace metal that would provide light weight, maximum strength, durable long life, minimum vibration and stability to assure continuous operation. **SOLVED THE G-E WAY:** This particular application provided the problem of selecting a material that would meet requirements and then to apply the material to assure maximum mechanical properties. With many grades of Textolite material from which to choose, it was not difficult to find the right type. Applying that material was accomplished through the close co-operation of G-E plastics engineers and the customer. The results: Reduced cam weight 80 per cent— reduced horsepower used 50 per cent—reduced noise and vibration 200 per cent—reduced installation costs 30 per cent—elimination of metal to metal contact and resultant fatigue—increased machine speed 100 per cent—low inertia—rapid starting and stopping—provided uniform cam structure and perfect balance. United Shoe turned to Textolite for a definite and very worth-while use. Why don't you find out where this laminated material can help improve your product? Write Section E-20, Plastics Department, General Electric Company, One Plastics Avenue, Pittsfield, Massachusetts.

PD-101

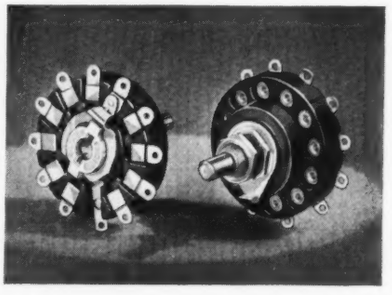
GENERAL ELECTRIC

(*Continued from Page* 72)

as much as 100 degrees below the company's original Polymerin. It has excellent resistance and durability qualities, comparing favorably with high-bake Polymerin, except in special cases. The new finish is expected to have application for finishing nearly any kind of metal product and some others.

Small Tap Switch Added to Line

MODEL 111, a small size, open type, high current tap switch has been added to the line made by Ohmite Mfg. Co., 4835 Flournoy street, Chicago. Five sizes of high current tap switches are now available, in ratings from 5 amperes, 120 volts, to 75 amperes, 240



Five sizes of high current tap switches are now available, following introduction of a small size nut

volts. Model 111, like larger Ohmite units, is a multipoint, load-break, nonshorting, single pole rotary selector particularly designed for alternating current use. It is all-ceramic in construction, and has silver-to-silver contacts which are self-cleaning.

Dynamotors Start on Low Current

A WIDE range of sizes is offered in the new line of precision-built dynamotors announced by Eicor Inc., 515 South Laflin street, Chicago. Requiring a low starting current, these dynamotors are light in weight per watt output. They function as a power supply for aircraft, police, and marine transmitters and receivers.

Engineering Dept. Equipment

Erasing Shield Announced

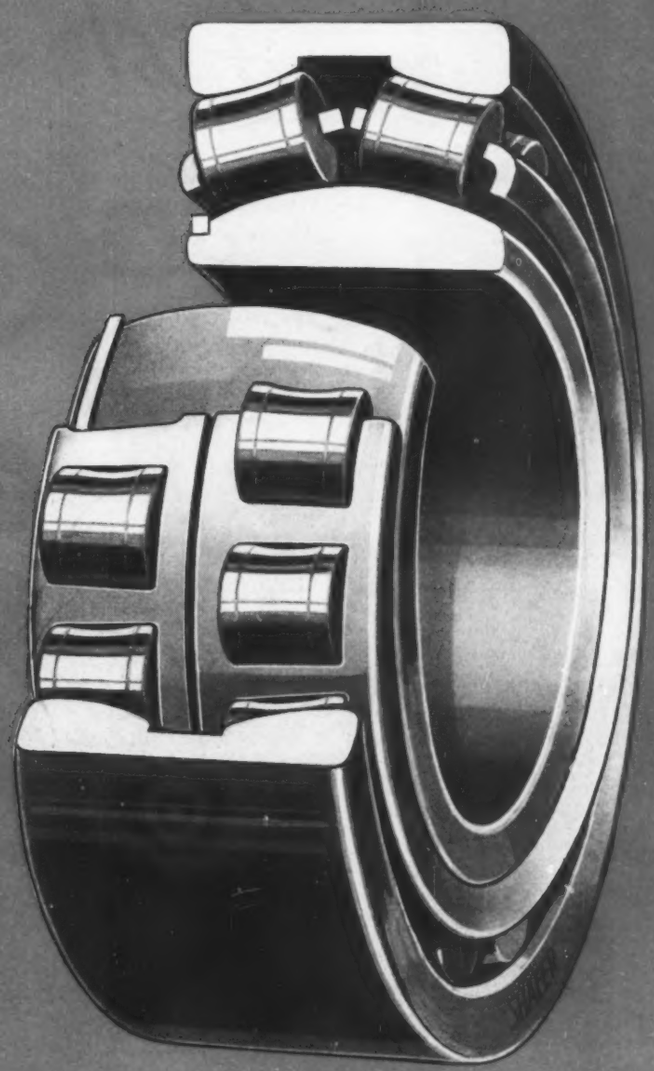
A "SKID-PROOF" erasing shield is announced by Eugene Dietzgen Co., Chicago, and is provided with cupped openings for the finger and thumb which grip the shield firmly to the paper and prevent the shield from slipping. Measuring 2⅜ x 4⅜ inches, the shield has 14 openings,.

Circuit Tester Is Flexible

KNOWN as the model 785, a new circuit tester possessing unusually wide flexibility of use for individual measurements on all types of control and signal equipment, as well as electronic apparatus, is announced by Weston Electrical Instrument Corp., Newark, N. J. It has 27 complete ranges for voltage, current and resistance measurements. Applications include checking sensitive relays, signal systems, cathode

SHAFER "DE" SERIES

GENEROUS THRUST CAPACITY is provided in an unusually compact and easily applied bearing, in the new "DE" Series self-contained double row Shafer Bearings. The concave roller-convex raceway design assures efficient load distribution, integral self-alignment, and ability to handle radial loads, thrust loads in either direction, or any combination of radial and thrust loads. Shafer "DE" Series solves many difficult bearing problems. Consult Shafer engineers for specific recommendations.



SHAFER BEARING CORPORATION
35 EAST WACKER DRIVE • CHICAGO, ILLINOIS

•

New Catalog No. 15 gives complete data on Shafer "DE" Series Bearings and the full line of single and double row bearings and stock mounted units.

•

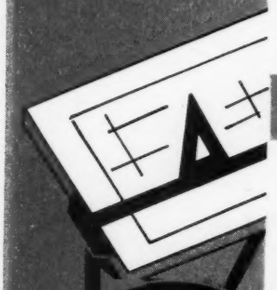
CONCAVEX

SHAFER *Radial-thrust* ROLLER BEARINGS

If Service is important to you.. ..Here it is!

THERE are two advantages of service we have to offer you —you'll find them to be as dependable as Accurate quality.

1. Whatever your production schedules demand, we see that Accurate service satisfies them. You simply tell us what you want . . . when you need it . . . and that's when you get it. It's mighty important to us to deliver on time, because it's important to you.



2. There is the Accurate engineering department ready to serve you with its knowledge and experience—to help you work out problems of redesign, or to engineer a new spring for a new product. This is a service for you that costs you nothing while it can save you money and improve your product.

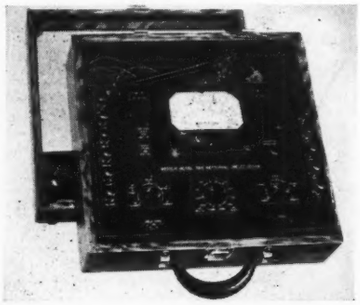
Use these two features of Accurate service. You'll certainly profit by them as sure as you'll profit by Accurate quality.

Send for your FREE COPY of the Accurate Handbook on springs. It's informative and compact.

Accurate Springs

ACCURATE SPRING MFG. CO.
3813 W. Lake Street Chicago, Ill.

ray tubes, remote control circuits, public address systems, amplifiers; measuring photocell currents, tele-



Twenty-seven complete ranges for voltage, current and resistance measurements are provided in new circuit tester with wide flexibility

phone circuits, commercial motor voltages, electronic circuit values and filament and cathode voltages on thyratron tubes.

Will Beryllium Fill a Larger Niche?

(*Continued from Page* 53)

mately 66 to 29 per cent that of copper.

Although at present production and fabrication of beryllium-nickel alloys has not progressed as far in this country as abroad, nickel and nickel alloys can be made heat treatable by adding small amounts of beryllium and unusual toughness combined with high tensile strength is obtained with this combination.

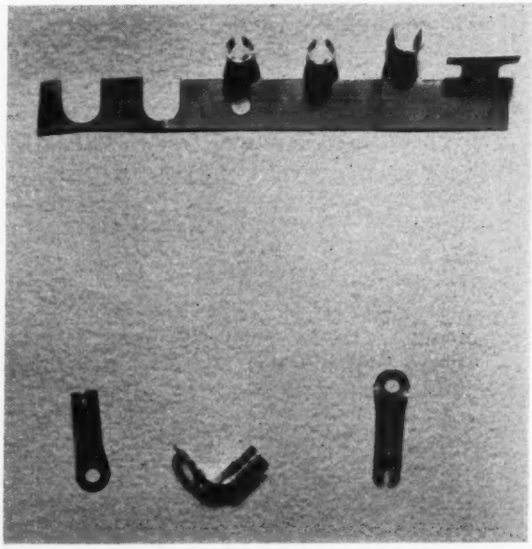


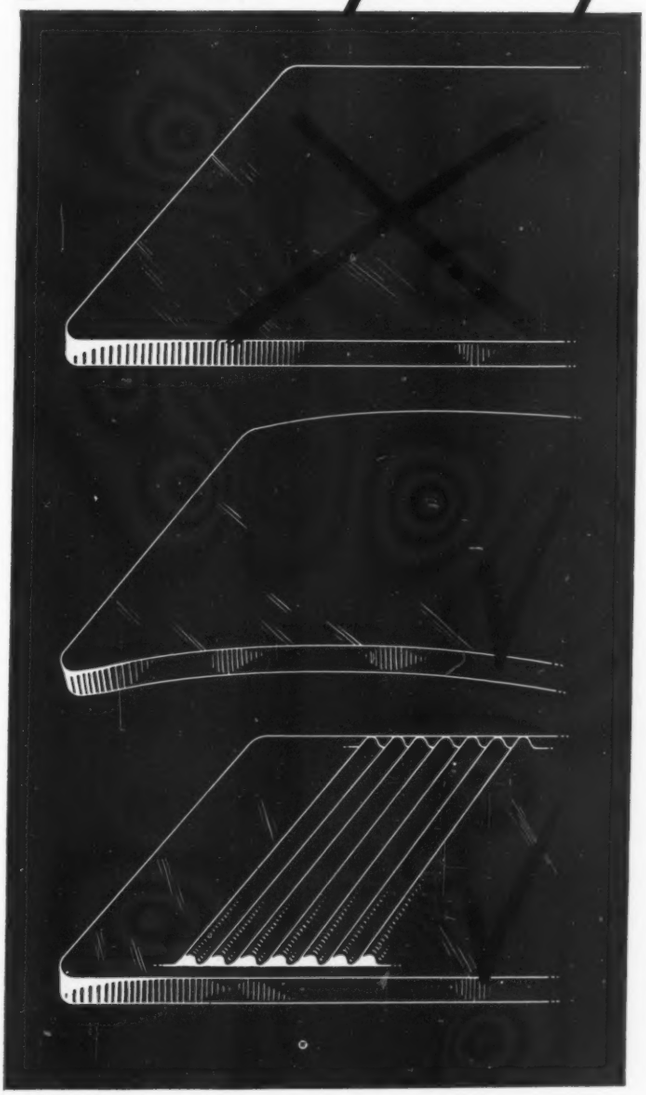
Fig. 7—Solderless connectors used in automotive lighting systems in place of soldered joints

Many problems are encountered in melting and pouring these alloys and specialized equipment is necessary in fabrication.

Beryllium nickel has shown values ranging from

NUMBER 1 OF A SERIES

Designing FOR DIE CASTING



Avoid Plain Flat Areas — Save on Finishing Cost

• In designing for ZINC Alloy Die Casting, it is desirable to avoid large plain flat areas—particularly if an exceptionally smooth surface for finishing is required.

To eliminate the problems involved in casting plain flat areas without introducing difficulties in finishing, it is suggested that such areas be modified by slightly curving the flat portions—or by breaking the surface with some simple design.

This is the first of a series of advertisements scheduled to appear in these pages giving suggestions to aid the product designer in getting full value for his ZINC Alloy Die Casting dollar.

We suggest that you ask a commercial die caster for a copy of the new book "DESIGNING FOR ZINC ALLOY DIE CASTING"—or write to The New Jersey Zinc Company, 160 Front Street, New York City.

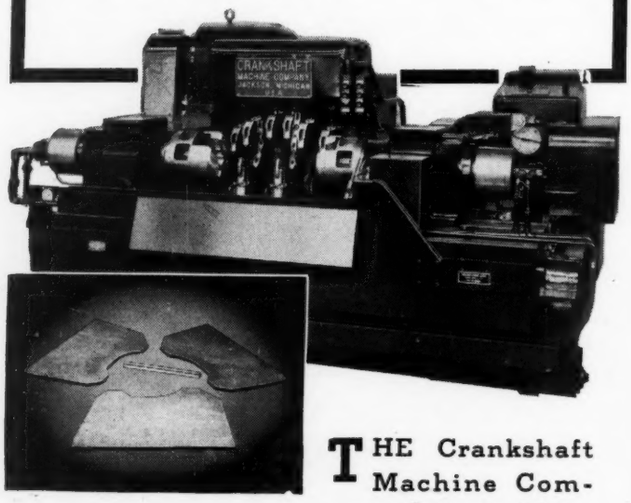
ZINC ALLOY DIE CASTINGS

The Research was done, the Alloys were developed, and most Die Castings are made with

HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

AMPCO'S WEAR RESISTANCE

. . . A VITAL FACTOR TO "CRANKSHAFT" LATHES



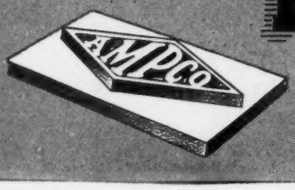
THE Crankshaft Machine Company, Jackson, Michigan, builders of internationally famous crankshaft lathes for the automotive industry, chooses Ampco Metal for parts requiring a high degree of wear resistance and resistance to fatigue and impact—such as side plates for tool arm spacers and for thrust plates on tool arms. This is another instance of the preference for Ampco Metal for extreme service parts. File 40 of Ampco Engineering Data Sheets will interest you—write for a copy.

AMPCO METAL INC.

Dept. MD-2 Milwaukee, Wisconsin

"The Metal without an Equal"

AMPCO METAL



. . distinguished by this mark.

25.2 per cent elongation at 176,000 pounds per square inch to 8 per cent elongation at 260,000 pounds per square inch, with a 4-inch test length. Even good alloy steels often have not these properties. German experimenters have found two distinct types of beryllium-nickel alloys suitable for commercial use. One contains 1.7 to 1.9 per cent beryllium, the other has 60 per cent nickel, 15 chromium, 7 molybdenum and .6 to 1 per cent beryllium. Like beryllium copper, these alloys show a marked increase in physical properties after being quenched from the solid solution condition to a soft state and then reheated at an intermediate temperature. Hard rolling and further heating will further raise values, as the following table shows.

Alloy	Yield pt. lbs. /sq. in.	Tensile Strength lbs./ sq. in.	Elong. pct./ 100 mm.	Brinell Hardness
Beryllium nickel:				
Heat treated from soft	109,000	176,000	42.9	365
Heat treated after hard rolling	213,000	260,000	8.3	460
Beryllium-nickel-chromium-iron:				
Heat treated from soft	70,100	132,000	22.8	470
Heat treated after hard rolling	213,000	263,000	6.0	430

Effects of Beryllium on Iron, Steel

Additions of beryllium to iron and steel have both good and bad aspects, and this work has not advanced far as yet. Stainless steels containing 12 per cent chromium, 7 nickel, 1 per cent beryllium and no carbon can be hardened to 675 brinell, but 18-8 stainless loses much of its corrosion resistance if beryllium is added. Precipitation-hardening of nickel-iron and nickel-chromium-iron alloys is possible with beryllium. In France it is reported that iron and iron alloys have been casehardened with beryllium by cementation, to a hardness considerably greater than that obtained from nitriding.

The combination of magnesium and beryllium would seem in many ways to be ideal, but the metals do not alloy. Beryllium and aluminum have insufficient ductility when rolled, but castings of this alloy may be developed, so long as low elongation does not matter.

It is evident from this article, therefore, that unless uses are developed for pure beryllium—and this is now a remote hope—beryllium for the present will remain metallurgically important because of its ability to harden copper, nickel and iron.

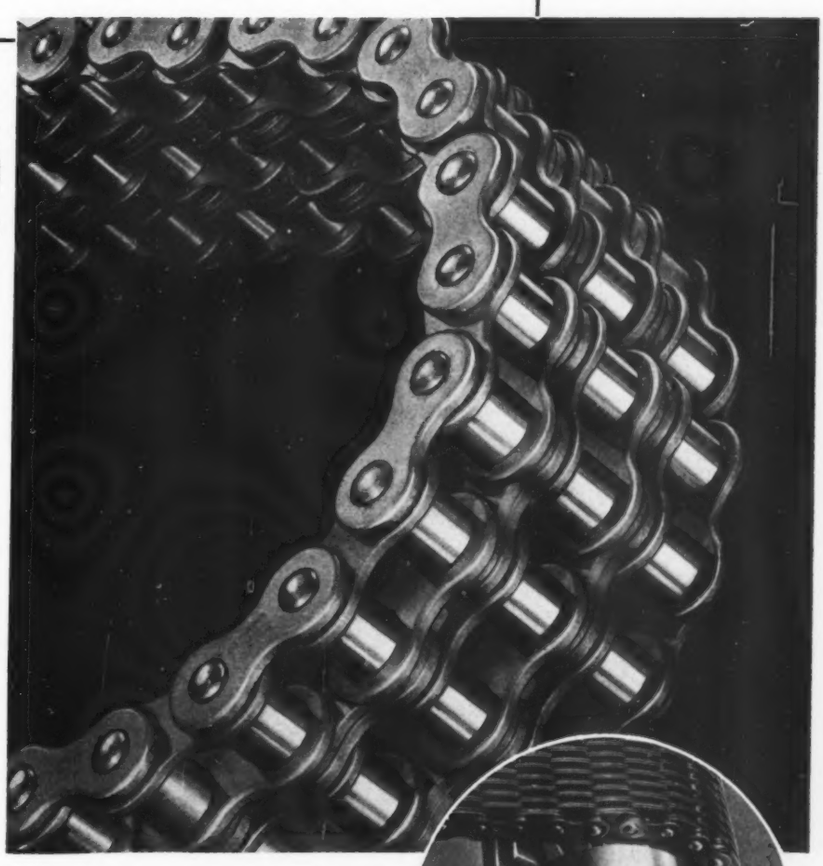
The editors gratefully acknowledge the co-operation of the following companies in preparation of material for this article: American Brass Co. (*Figs.* 1, 4, 5, 6); Beryllium Corp. of Pennsylvania (*Figs.* 2, 3, 7); Brush Beryllium Corp.

Said to eliminate the conventional blue ground coat and one or more cover coats, the Hommelaya process of vitreous enameling has been developed by the O. Hommel Co., Pittsburgh. It is claimed to result in a superior enamel having a satisfactory finish in only one fire. Production is increased at least one-third.

"Let's Get

WHITNEY'S IDEAS

on those Power Drives"



Whitney engineers have a background which includes the design of power transmission and conveyor chains for every field of industry. With this experience . . . and from the complete line of Whitney Roller, Silent and Conveyor Chains . . . they are readily able to recommend *and help you to work out exactly* the right drive to provide positive power for every application.

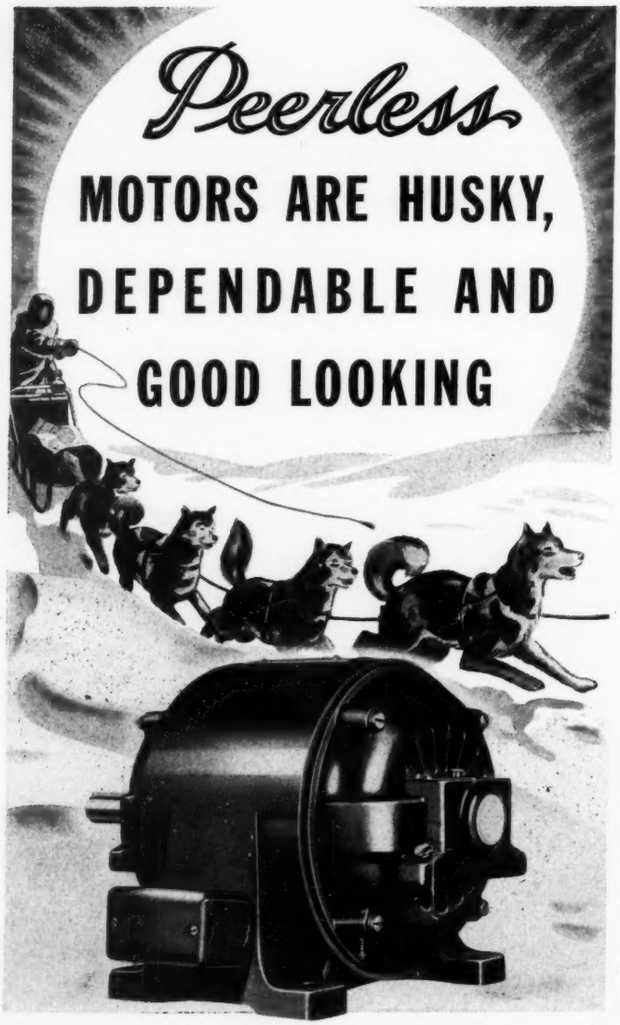
For these reasons, machine designers and builders often find it possible to save time and trouble by getting Whitney's ideas . . . at the outset . . . on all types of power drives. And they find that Whitney Chains never let their products down in service. You, too, are free to consult with Whitney engineers at any time. Just drop us a line and say when. No obligation at all.

WHITNEY PRODUCTS

Roller Chain & Sprockets • Silent Chain & Sprockets • Conveyor Chain & Sprockets • Roller Chain Flexible Couplings • Automatic Load Limiting Sprockets • Automatic Drive Tensioners • Universal Chain Vises

WHITNEY CHAINS

THE WHITNEY CHAIN & MFG. CO., HARTFORD, CONN.



● Peerless Motors are built to take the hard going yet with all their huskiness comes plenty of "eye appeal." They will not only dress up the appearance and enhance the value of any piece of equipment but go a long way in increasing the life of that equipment.

They have plenty of stamina and reserve power to handle heavy loads and are absolutely dependable. Peerless' field of activity is focused entirely on the fractional to 10 H.P. field which accounts for their general widespread acceptance as the outstanding motor buy in the market.

Write for more detailed information or better yet let us have your motor problems. Without any obligation our engineers will prove to your satisfaction, that Peerless Motors on your own equipment are a better buy based on performance.

47 YEARS OF LEADERSHIP

PEERLESS ELECTRIC CO.
WARREN, OHIO

Whither Styling?

(*Continued from Page* 49)

mechanical perfection alone. Appearance has been easier to overlook in this industry than in the consumer goods manufacturing field because of the necessarily limited production and special applications.

Mass sales are simply a number of individual sales—and each individual sale is dependent upon a number of psychological reactions. Identical reactions take place during the sale of machinery as those widely recognized in the sale of consumer goods. Consequently, control of these factors through styling encourages sales. And machines—like products—are made for the purpose of selling.

Appearance, while it may possess little intrinsic value is nevertheless the most impressive feature. Attractive appearance is not only desirable, but actually necessary. Every line of a machine should say, "I am the result of careful planning. I am built of the finest materials; I am ready to serve your needs properly and with the least effort on your part."

Sleek lines of modern equipment are often used by the purchaser to advantage by conducting manufacturing operations in view of the public. Prestige and confidence established by styled equipment invariably results in product sales to onlookers.

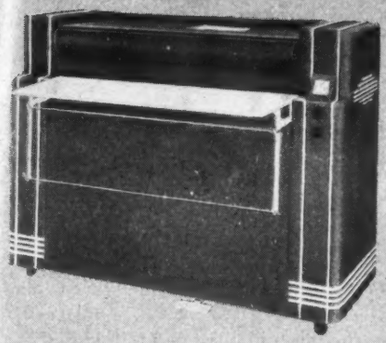
The custom of redesigning exteriors without adequate mechanical improvement cannot help but reflect unfavorably on sales. To the buyer, change in appearance unconsciously expresses improved mechanics. Failure to find increased utility results in a slower acceptance of future redesigns. From a sales standpoint, yearly or periodical models are not vital—good design has a long life, sometimes even increasing in value the second and third years of production.

In conclusion, it may be said that manufacturers of heavy machinery are awakening to the value of design for sales; industrial design will be more sensibly applied than on consumer goods, dramatic possibilities will be exploited and improvements in performance will go hand in hand with increased sales resulting from better appearance.

" . . . avoids heavy covers"

Raymond Loewy
New York City

TO ILLUSTRATE the principles of designing for both appearance and utility a typical problem will be discussed. The manufacturer of a well-known national product had the problem of restyling a machine. It was a complicated mechanism, making use of phototubes, and was the result of engineering and experimental efforts. The machine, however, was an unattractive conglomeration of mechani-



New Bruning Mercury "75" Printer

1 New Hanovia HIGH PRESSURE Mercury Quartz Lamp overcomes the disadvantages of old-time carbon arc machines. (Do not confuse Hanovia Tubes with low-pressure mercury arc tubes.)

2 Operates at speed of 20 feet per minute, with medium speed blue print paper or BW paper.

3 Current consumption only ⅓ that of carbon arc machines of equal capacity.

4 Positive, uniform distribution of light to entire printing surface—no flickering. Light remains practically constant throughout life of tubes.

5 GUARANTEED lamp life of at least 1000 hours.

6 No bothersome, time-wasting changing of carbons or globes.

7 Faster, easier, more economical operation with improved printing results.

8 New type drive, speed control, feed board, contact band, timing device, light intensity control.

9 Low operating, maintenance, first cost.

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* * *

The cost of the paper used in makin blue prints is less than ¼ of the cos of the finished print. Firms through out the country have found that the us of Bruning Black and White Prints re duces the remaining ¾'s of print cos more than enough to offset the sligh extra paper cost—and, at the sam time, speeds up their print productio Why don't YOU make this impo tant discovery? Mail the coupon fo FREE literature about the Bruning BW Printing Process.

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HANNIFIN high efficiency hydraulic cylinders give you stronger and simpler construction, with mountings that allow easy application to a wide variety of uses. All the advantages of hydraulic power, with smooth action, and powerful, easily controlled movement, are more readily available with this patented design.

NO TIE RODS. This simple, strong design eliminates a source of leakage and allows removal of end caps without collapse of other parts.

HONED BORE. Special mirror finish honing produces a straight, round, perfectly smooth cylinder bore. Perfect piston seal means maximum power and minimum fluid slip.

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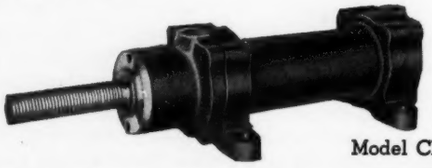
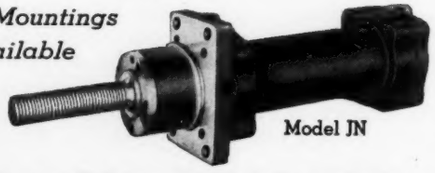
AIR VENTS. Each end cap has air vents on three sides. With inlet port at either side or bottom, there is always an air vent at the top.

ALL TYPES AND SIZES. Six standard mounting types, with small diameter piston rod, 2 to 1 differential piston rod, or double end piston rod, in all sizes for working pressures up to 1000 and 1500 lbs. per sq. in. Furnished with or without cushion. Other types built to order, any size, for any pressure. Write for Bulletin 35-MD with complete data.



Model CN

Other Mountings Available



Model JN

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HANNIFIN
HYDRAULIC CYLINDERS

cal parts, built on a large cast iron skeleton frame.

The company wanted to make this machine a more appealing item of equipment. It had a huge metal cover, a bulbous case that enclosed the mechanical parts. From an appearance standpoint it could not be severely criticized, but the basic problems had not been satisfactorily solved. While it is sometimes possible to enclose a mechanical device in a smooth shell or cover, in this instance the problem could not be reduced to such simple terms. What had been designed was nothing more than an immense metal envelope.

After the problem was analyzed it was found that the structure lent itself to reshaping. The main framework consisted of two large, open frame castings. Rather than covering the whole machine with a sheet metal housing, the skeleton castings were replaced by two new castings of the box type. The natural lines of the machine were followed which allowed the new structural curves to create an attractive form. For purposes of adjustment, repairs, oiling and servicing, suitable hand holes with small cover plates were provided in the castings.

The nucleus of the whole machine from the operating standpoint is an oscillating arm on the side of a large rotating drum. On the former design this arm was enclosed in a sheet metal cover. The cover was removed, the arm restyled and its design blended into that of the machine. Thus engineering, styling and good showmanship were combined.

Machine styling is more than the terminology implies. It does not merely create a new exterior form to make a mechanism pleasing; it makes ultimate shapes the expression of basic forms.

O. K. With Corrections

I dread to take a drawing to the man who wants to change things;
Who says, "That's fine, just what I want, but let us rearrange things.
Let's move that lever over, and change that to a wheel,
And add a little gadget to give it more appeal;
And leave out that center bearing, and hide those bolts completely—
If it aint too darn much trouble, make this drawing over neatly.
Don't clutter up the whole thing with a lot of useless figures;
But please don't leave out any of those most important triggers.
I suggest you try to streamline this part of the base;
And in the meantime, just clean up this other little case.
Those bolts are most unsightly in the place you have them now;
Just leave them out, by changing it just slightly; of course you will know how.
Don't get things mixed up and too darned complicated;
But use all those parts on hand, as was originally slated.
And keep the cost down to a very minimum;
As you know darned well, this is no millennium.
But make it big and strong, and far better than ever;
As you know our slogan is our only lever.
Give our salesmen just a tiny little break;
As you know, we are dependent on the orders that they take.
With these few minor changes, everything's O. K.
We are much behind our deadline; please finish it today."

—J. J. LOW, *Chief Engineer, Kay-Brunner Steel Products, Inc.*

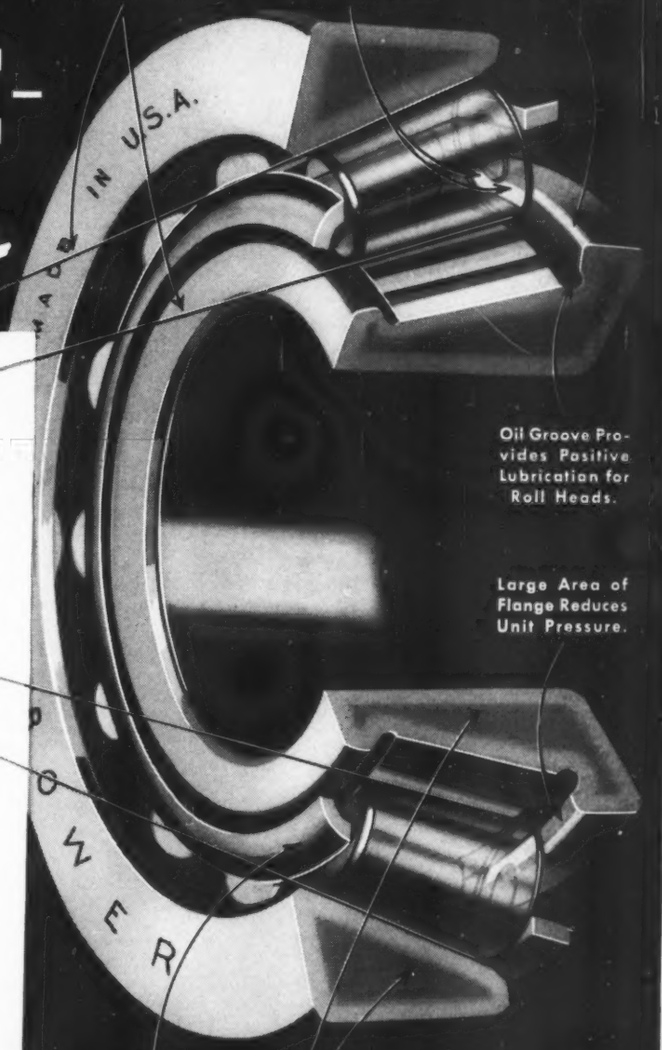
OF FIRST IMPORTANCE—

Design

Full Line Contact of Micro-Honed Surfaces Coincide on a Common Apex.

Two-Zone Contact of Roll End Insures Roll Alignment. (Patented Dec. 6, 1930, Patent No. 1784914.)

Ground Radius of Cone Flange Prevents Noise and Chipping.



Oil Groove Provides Positive Lubrication for Roll Heads.

Large Area of Flange Reduces Unit Pressure.

Multiple Perforated Retainer for Roll Spacing.

Case Hardened Alloy Steel Cup and Cone.

THIRTY-SIX years of Roller Bearing manufacture have proved that design is the most important element in a bearing.

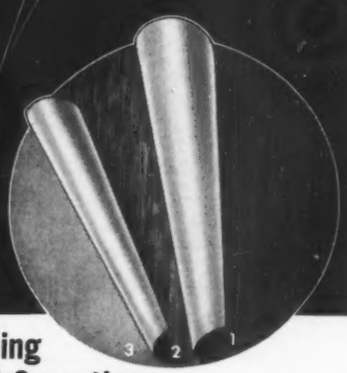
Likewise, the use of many millions of Bower Roller Bearings as original equipment over a period of many years in America's leading large-production automobiles has proved the correctness of BOWER DESIGN.

Bearing users will appreciate that the exacting standards of the automotive industry and the severe usage of bearings in automobiles offer a challenge that no roller bearing can meet unless it possesses the highest degree of quality known to the bearing industry.

One of the secrets of Bower's leadership is the fact that its technical men have never waited upon the ingenuity of other men. Bower engineers push relentlessly ahead—far beyond the needs of the moment—to make new technical discoveries and to apply them always in ADVANCE.

This Tapered Roller Bearing is a leading example of Bower design. It embodies important advantages that no other bearing possesses—advantages that Bower engineers discovered and incorporated ahead of all others.

For more detailed information on Bower design, ask us for a copy of the folder, "Secrets of Bower Roller Bearing Design and Quality."



Bower Micro-Honing
A "Face-Lifting" Operation

1. ROUGH GROUND—Photomicrograph—25 diameters—showing amorphous film with roughness of approximately 15 micro-inches (millionths of an inch). **2.** FINISH GROUND—More but finer scratches—surface finish of approximately 10 micro-inches composed of amorphous metal left by finish grinding—Photomicrograph of 25 diameters. **3.** MICRO-HONED—25-diameter photomicrograph showing amorphous metal and grinding marks removed, baring hard surface and smoothness of approximately 3 micro-inches—scratches below surface.

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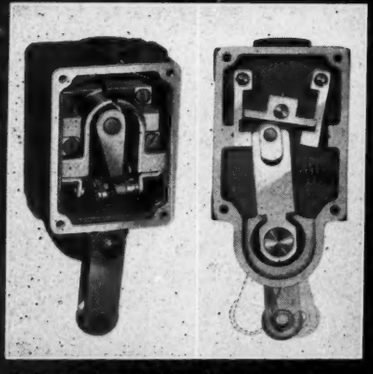

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(*Concluded from Page* 46)

design, a movement of the blade fork about the vertical pivot in either direction will result in the depression of the plunger as its roller engages one or the other of the two nodes of the cam.

Each blade has an extension link at its root which serves the purpose of an elongated universal joint incorporating the vertical and horizontal blade pivots. The outer end of the extension link carries the double node blade damper cam and the inner end carries droop and coning stops.

Power for the rotor starting system is obtained through a gear drive from the rear end of the engine crankshaft. A simple cone clutch drives through a shaft with a bevel pinion. Meshing with this, a bevel gear transmits the drive to the rotor shaft running in front of the pylon strut. A three-tooth, spring-loaded dog clutch is located in this shaft and engages as soon as rotation starts. Two universal joints in each shaft compensate for alignment. After ship is in flight, no power is required for the rotor.

The special cockpit instruments include a bank and turn indicator, a directional giro, a climb indicator, a carburetor air thermometer, an outside air thermometer and a suction gage in addition to a regular two way radio and other instruments necessary for flying.

Topics

(*Concluded from Page* 30)

ent resistance; and the new cylinder "finning," which carries heat from the engine much more rapidly and permits an increase in speed and efficiency of an engine by as much as 300 per cent. By combining these two factors with advances in propeller design, "safety fuels," a new device for synchronizing two or more engines, and new cowling, the airplanes of tomorrow are expected to make the existing models seem like "lumbering trucks" by comparison.

BASED on results of studies of belt life over a period of ten years, the power ratings of multiple V-belt drives have been revised by Allis-Chalmers, working with numerous industry representatives. Sheave diameters and correction factors are now standardized according to formulae derived from the tests. Overload factors are being arranged also to allow for the type of prime mover and driven machine. In many cases the new ratings provide for a more compact drive and for the longest belt life at the lowest initial cost.

MANUFACTURERS' *publications*

ALLOYS (IRON)—Five principal reasons why Meehanite finds extensive use in pressure castings are discussed in a 12-page booklet, bulletin No. 10 issued by Meehanite Research Institute of America Inc., 311 Ross street, Pittsburgh. Included are numerous illustrations of service applications.

ALLOYS (NICKEL)—Technical bulletin T-9, "Engineering Properties of 'K' Monel," has been revised by The International Nickel Co. Inc., 67 Wall Street, New York. A complete discussion of the metal is given, including its properties, instructions for working, heat treatment, and applications.

ALLOYS (STEEL)—A new catalog containing ideas and suggestions on heat and corrosion resistance problems has been published by the Standard Alloy Co., 1679 Collamer road, Cleveland. Specific problems with castings are brought out, and some of the most widely used Standard alloys are shown.

BEARINGS (BALL)—Catalog No. 110, the most complete compilation yet issued by the company, has been published by Nice Ball Bearing Co., Nicetown, Philadelphia. Besides general information on applying these bearings, the catalog gives dimensions, list prices, and load ratings for all types of its bearings. Photographs, cross-sectional drawings and attractive layout add to the book's value.

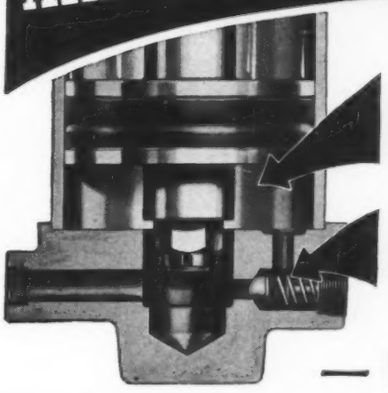
BEARINGS (BALL)—Publication of the 1940 edition of its Ball Bearing Interchangeability tables, booklet R-5, is announced by New Departure division, Bristol, Conn.

BEARINGS (BRONZE)—Catalog L-2, just issued by Johnson Bronze Co., New Castle, Pa., describes Ledaloyl self-lubricating bearings in more than 850 stock sizes. Considerable technical and application information is included with sizes, part numbers and prices.

BEARINGS (ROLLER)—Shafer Bearing Corp., 35 East Wacker drive, Chicago, has just published catalog No. 15, a complete index to the company's line of radial-thrust roller bearings and self-aligning ball and roller bearing units. Standard models are shown but many special housings are available. Prices, specifications and special information round out the data on all types.

BELTING—A new 24-page catalog section of fractional horsepower V-belt drive has been issued by the B. F. Goodrich Co., Akron, O. Nine separate steps by which the selection of a V-belt drive may be made are

NOW WRITE *Cushioned* IN ALL AIR CYLINDER "SPECS"



New Self-Regulating Air Cushion by NOPAK eliminates need for non-cushioned cylinders.

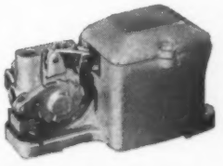
Quick-Opening Air Duct assures quick starting under full power.

— Give Your Machines New Smoothness

Instead of specifying "cushioned" or "non-cushioned" cylinders, simply specify NOPAK Cushioned Air Cylinders in one of these types:

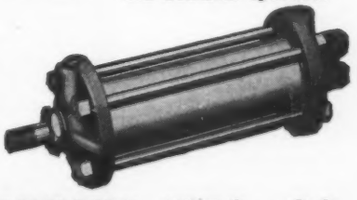
- New type NOPAK Cushioned Air Cylinders with *Self-Regulating* Cushion-Heads. They eliminate the noisy, damaging metal-to-metal impact of non-cushioned cylinders . . . yet sell in the *same* price range.
- Standard type cushioned air cylinders with *adjustable* Cushion-Heads . . . where close regulation of "cushion effect" at end of piston stroke is required.

Either type assures smooth, efficient, trouble-free performance of air powered equipment, prolonged life for pistons and cup-leathers, lower maintenance cost for the entire cylinder assembly. Both types have Special Composition Cup Packing and extra-wide piston bearing to protect cups from excessive wear and friction. Write for bulletin.



For positive control, specify famous patented NOPAK Air Operating Valves . . . Lever, Foot and Solenoid operated.

NOPAK Self-Regulating Cushioned Air Cylinder with Pendulum Mounting. Made in all Standard Mountings.



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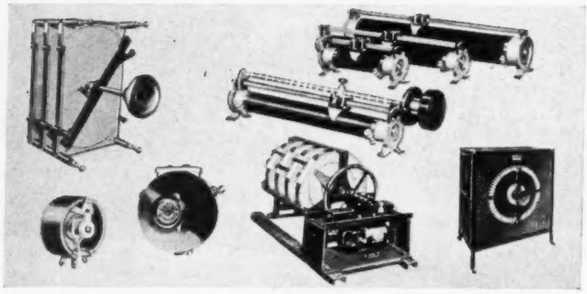
A 2490-½



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The bulletins on Ward Leonard Rheostats are probably the most complete compilation of Rheostat data ever assembled by a single manufacturer. Besides types and ratings, the subjects of manual and motor drives, mountings and accessories are completely covered. Send for a complete set of the latest Ward Leonard Rheostat Bulletins.

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ELECTRIC CONTROL DEVICES SINCE 1892.

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Pyott has developed a system of using flexible stock patterns with which practically any round casting in semi-steel or grey iron can be reproduced accurately, economically and in less time. Casting diameters range: 2" to 144" inclusive—any weight—any thickness. Send rough sketch with accurate dimensions for quotation. Satisfaction guaranteed. Let Pyott also quote you on semi-steel or grey iron castings made from your own patterns. Castings delivered finished or semi-finished as you prefer.

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clearly explained and an example is given with each. Conversion of belt numbers and standard fractional horsepower V-belt pulley groove top widths is listed also.

CAST PARTS (DIE)—The New Jersey Zinc Co. has published a booklet, "Zinc Alloy Die Castings in Small Tools," which, besides the specific coverage indicated by its title, contains information on various machine parts made from zinc die castings. Large size pictures are used in most instances to tell the story, while copy is brief.

CONTROLS (ELECTRICAL)—The new SCI relay for synchronous motor control is discussed at length in catalog GEA-1724B issued by General Electric Co., Schenectady. Various parts of the relay are described separately and a chart is presented showing the action of the control during pull-in and pull-out.

COUPLINGS (FLEXIBLE)—Insulated flexible couplings of five different types are described and illustrated in bulletin MF-16, published by Charles Bond Co., 617 Arch street, Philadelphia. Considerable design information relating to application of the units is included. Specifications and prices are given.

COUPLINGS (FLEXIBLE)—Valuable information on means of guarding against effects of misalignment of connected machine shafts is contained in a new illustrated catalog issued by Farrel-Birmingham Co. Inc., 344 Vulcan street, Buffalo, N. Y. This catalog, No. 443, explains the function of a flexible coupling and describes how Farrel Gearflex couplings compensate for parallel or angular misalignment or a combination of both.

CONVEYING EQUIPMENT—Robins Conveying Belt Co., 15 Park Row, New York, has published bulletin No. 109, briefly describing its complete line of conveying equipment. These parts include roller bearing idlers, conveyor pulleys and many other parts.

ELECTRICAL EQUIPMENT—Booklet GES-2136 published by General Electric Co., Schenectady, is titled, "Little-Known G-E Products for Industry." Among other things, it describes GE products for use in the machine design field, primarily instruments for engineering department use in testing.

ENGINES (DIESEL)—Some of the questions most often asked regarding diesel engine construction, operation and care are answered in a "Question and Answer" booklet just issued by Hercules Motors Corp., Canton, O. Illustrations of various types give weight to text.

FINISHES (WRINKLE) — Number six of "New Wrinkles in Finishing," has been published by New Wrinkle Inc., Mutual Home building, Dayton, O. As usual, new applications for these finishes are discussed and illustrated and qualities are pointed out.

JOINTS (EXPANDING)—A revised, eight-page il-

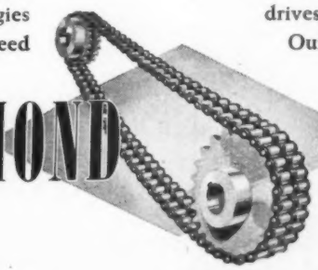
Making Roller Chains for Every Power Transmission Purpose

For 50 years Diamond has concentrated all efforts and resources to one purpose—the making of better Roller Chains and Sprockets and applying them to the power transmission needs of industry.

50 years at one job have built a reservoir of manufacturing and application experience which has made possible the anticipation and meeting of the fast developing needs of industry. Diamond Chains were used on the safety bikes of the early 90's and are used on today's streamliners,—on the first gasoline buggies and on the 1940 model cars for the high speed timing drives,—for driving the propellers of the first successful airplane (Wright brothers, Kitty-hawk) and today on modern airliners for operating important controls.

Beginning with the mechanization of industry in the early 1900's, machinery designers have made wide use of Diamond Chains and production men have found this efficient and positive means of power transmission a genuine aid to lower costs, more uniform quality and higher production rates. Diamond Roller Chain Drives are in daily use in more than one hundred major divisions of industry and in every kind of power transmission service, including the heavy slow speed drives, precision high speed timing drives, and motor drives of every kind and size.

Our 50 years of experience is at your disposal; your inquiries are appreciated as much now as in our earlier days. DIAMOND CHAIN & MFG. CO., 435 Kentucky Ave., Indianapolis, Indiana. Offices and Distributors in All Principal Localities.



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"MORE OF THE SAME"

Micro-Weave
MORE THAN 180 FLAWLESS THREADS PER SQ. INCH

Micro-Weave
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TRACING CLOTH

Change to Microweave Tracing Cloth and you'll acquire a habit—for this better product has what it takes to make the most exacting draftsman say "More of the same" when it's time for a new supply. Testing laboratories say it's tops in fine, flawless weave, transparency, persistence of surface under erasure, maximum strength with minimum bulk. We'd like to have you try a generous working sample. A post card brings it.

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Let us help. Our engineers are ready to show you how Pulsolator can automatically lubricate your machines for life.
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BLANCHARD PULSOLATOR

lustrated bulletin No. 35-20A has been published by the American District Steam Co., North Tonawanda, N. Y., describing its internally-externally guided expansion joint. Showing sizes from 1¼ to 20 inches, the bulletin also includes specifications, dimensions, weights and list prices.

MOTORS—General purpose universal motors made flat so the motor may be mounted to occupy a minimum of space, are described in a new leaflet F-8494, issued by Westinghouse Electric & Mfg. Co., East Pittsburgh. Holes are drilled and tapped in one of the flat sides to permit attaching a mounting bracket.

MOTORS—Type T explosion-proof direct current motors are described and illustrated in bulletin 220, issued by Reliance Electric & Engineering Co., Cleveland. A cross-sectional view particularly brings out the design of the units. Features are discussed in some detail.

MOTORS—Universal governor controlled motors, available in sizes from 1/50 to 1/20-horsepower, are described in a new leaflet, F-8498, of the Westinghouse Electric & Mfg. Co., East Pittsburgh. These motors are applied for quiet, lightweight drives in adding machines, cameras, typewriters, and similar machines.

PRINTER—The Portaprint machine which produces white paper prints with dark lines of drawings and letters is described in a large illustrated folder in color issued by Eberbach & Son Co., Ann Arbor, Mich.

PULLEYS—Sprucolite motor pulleys, made from laminated layers of veneer sheets arranged so the grain of each sheet runs at right angles to that of its neighbor, are described in a bulletin issued by American Pulley Co., 4200 Wissahickon avenue, Philadelphia. List prices are given.

PUMPS—Burks condensation return units are described and illustrated in catalog bulletin No. 104D published by Decatur Pump Co., Decatur, Ill. Performance and dimension drawings of the various models add greatly to the bulletin's effectiveness. Price lists and specifications are included.

PYROMETERS—Leeds & Northrup Co., 4934 Stenton avenue, Philadelphia, has issued catalog N-33B, "Micromax and Speedomax Rayotube Pyrometers," showing some of the specialized temperature measuring problems to which Rayotube detectors are being applied. Photographs in color and diagrams help to clarify the picture.

SPEED REDUCERS—A new catalog containing selection tables, dimensions and prices on its complete line of motorized speed reducers has been issued by D. O. James Mfg. Co., 1114 West Monroe street, Chicago.

SPEED REDUCERS—Bulletin 22-25C has been published by Janette Mfg. Co., 556 West Monroe street, Chicago. It gives complete information on speed reducers covering a range from 1/50 to 10-horsepower.

When to use the SPLIT-PHASE MOTOR

Number One of a series on **"How to Select a Small Motor for your Machine"**

The satisfactory performance of a motor-driven machine depends very largely upon the characteristics of the driving motor. In this and future articles, the special advantages and limitations of different types of fractional-horsepower motors will be outlined. All these motors, and many others, are available in the standard Bodine line. Bodine engineers will be pleased to supply you with more detailed information.

The compact construction of Bodine motors makes them well adapted to small devices. A 1/50 hp split-phase motor like that above is less than 3 3/8" in diameter.

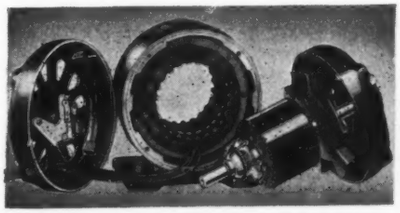
The split-phase motor is the most widely used of all small motors. When a single-phase a-c motor is desired and speed variation is not required, the split-phase motor is usually very satisfactory.

Common Uses

Split-phase motors are used extensively on home construction tools, washing machines, ironers, automatic musical instruments, and many types of industrial equipment.

Principle of Operation

The phase difference between the main and auxiliary windings creates a rotating magnetic field, which starts the motor. Once up to speed, the motor acquires a running torque, and the high-resistance auxiliary winding is automatically disconnected by means of a centrifugal cut-out switch.



Basic elements of the split-phase motor—wound stator, rotor, and cut-out switch.

Characteristics

The speed of a split-phase motor is fairly constant and depends on the number of poles and the circuit frequency. Acceleration is rapid and the full running speed is attained in a very few seconds. At starting, the motor draws 5 to 10 times its running current and develops about 150% of full-load torque. Maximum efficiency is attained at full load.

Advantages

The split-phase motor, despite its centrifugal switch, is one of the simplest of all fractional-horsepower motors and hence one of the least costly. It has no commutator or slip rings to cause trouble. In addition, it has good efficiency, fair capacity for its frame size, fairly constant speed, and good starting torque.

Limitations

The most serious limitation of the split-phase motor is its high starting current, which is 5 to 10 times the running current. Frequent starting may result in high temperatures in the starting winding and may also cause trouble in the cut-out switch. The split-phase motor cannot be satisfactorily controlled to obtain variable speeds. Furthermore, it cannot develop starting torques in excess of 150% of full-load torque.

***SPEED REDUCERS** can be built into all Bodine split-phase motors.*

BODINE ELECTRIC COMPANY • 2258 W. OHIO ST., CHICAGO

YOU WILL FIND EVERY TYPE OF SMALL MOTOR IN THE BODINE LINE

Split-phase motors are only one of many types in the Bodine line. No other manufacturer can offer more types and sizes. Included are split-phase, capacitor, shaded-pole, synchronous, and polyphase a-c motors; shunt and compound d-c motors; series universal motors; and speed reducer and governor motors. Write for recommendations.

1/2000 TO 1/6 H. P.

BODINE

BODINE

FRACTIONAL HORSEPOWER

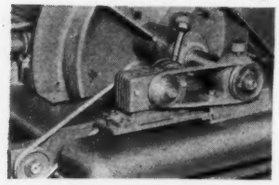
MOTORS

ENGINEERED FOR YOUR PRODUCT

IMPROVE EQUIPMENT SPEED SALES with

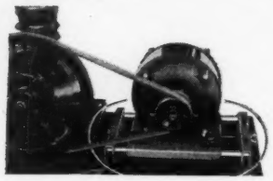
IDEAL "SELECT-O-SPEED" Transmission

Low cost variable speed transmission. Gives your machines a new, powerful selling argument.



Features include: Infinite selection of speeds over a 5 to 1 range (higher ratios available); simple, rugged (all steel) construction; sizes from fractional to 7½ H.P.; standard V-Belts used.

IDEAL "Automatic" Tension MOTOR BASE



Practical, low cost spring-tension motor base gives your products a new and potent appeal to buyers. Maintains correct belt tension on any mounting under any type of load. Saves power. Reduces bearing, belt and motor wear and repairs. *Makes short center drives satisfactory.*

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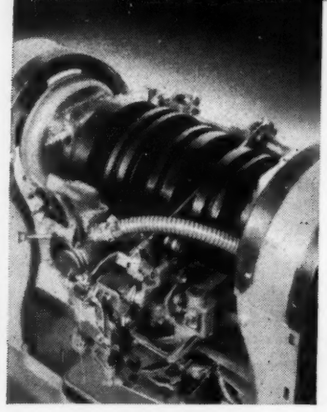
Transmission Division

IDEAL COMMUTATOR DRESSER COMPANY

1059 Park Avenue **Sycamore, Illinois**

NEW TEXTOLITE LAMINATED USES



TEXTOLITE CAMS FOR UNITED SHOE STITCHING MACHINES

A TOUGH PROBLEM BECOMES A SMOOTH-RUNNING LOW COST OPERATION

United Shoe Machinery Corp. needed a material to replace metal for cams that would provide light weight, maximum strength, durable long life, minimum vibration, and stability to provide continuous operation. Textolite Grade No. 2001 was the right material and this is what it did.

Reduced cam weight 80 per cent—reduced required horsepower 50 per cent—reduced noise and vibration 200 per cent—reduced installation costs 30 per cent—eliminated metal to metal contact and resultant fatigue—increased machine speed 100 per cent—low inertia—rapid starting and stopping—provided uniform cam structure and perfect balance.

United Shoe turned to Textolite for a definite and very worth-while use. Why don't you too find out where this laminated material can help improve your product? Write Section I-20, Plastics Department, General Electric Company, One Plastics Avenue, Pittsfield, Mass.

GENERAL ELECTRIC

PD-104

Oil Filters Protect Machines

(*Concluded from Page* 45)

space saving, and eliminating of need for a filter sump and often for a filter head.

The oil filter application in *Fig.* 6 is not a built-in one, because of the peculiar nature of the machine, but it is an unusual one because the machine itself owes much of its dependability to oil filters. The machine makes aluminum molding, and the problem was faced of removing all fine metal particles from the lubricating oil on its passage from the sump to the machine. The trouble was solved and clean filtered oil is now fed under the rollers and cutting surfaces, insuring smooth cuts and ultimate polished surfaces.

In recent years, probably the most significant development in filtration has been the trend toward automatic operation. At first available power from the machine itself was utilized to turn and clean cartridges by means of ratchet wrenches and cam clutches. Electric motor drives came to be used for this purpose and the self-cleaning filter has been another late development, on the head of which is mounted a completely self-contained oil driven motor.

Preparation of material for this article was aided by co-operation of the following companies: Cuno Engineering Corp. (*Figs.* 1, 3); The DeLuxe Products Corp. (*Fig.* 7); The Hilliard Corp.; Klemm Automotive Products Co.; The Kraissl Co.; Motor Improvements Inc.; Wm. W. Nugent & Co. Inc. (*Figs.* 2, 4); Skinner Purifiers Inc. (*Fig.* 5); Winslow Engineering Co. (*Fig.* 6); Zenith Carburetor division, Bendix Aviation Corp.

Meetings and Expositions

March 6—

American Society for Testing Materials. Regional meeting to be held at Statler Hotel, Detroit. C. L. Warwick, 260 South Broad street, Philadelphia, is secretary.

March 6-9—

Industrial Tools & Equipment exhibition to be held at Bridgeport, Conn. Sponsored by Bridgeport Tool Engineers association, State Armory, 1494 Main street, Bridgeport, Conn. Further information may be obtained from R. T. Phipps, 271 Grovers avenue, Bridgeport, Conn.

March 11-14—

American Society of Bakery Engineers. Annual meeting to be held at Edgewater Beach hotel, Chicago. Victor E. Marx, 1541 Birchwood avenue, Chicago, is secretary.

April 7-13—

American Ceramic Society. Annual meeting to be held in Toronto. Ross C. Purdy, 2525 North High street, Columbus, O., is secretary.

April 8-12—

American Chemical Society. Semiannual meeting to be held at Cincinnati. Further information may be obtained from Dr. Charles L. Parsons, 728 Mills building, Washington, secretary.

April 18-19—

National Petroleum association. Semiannual meeting to be held at Hotel Cleveland, Cleveland. M. C. Mallon, 930 Munsey building, Washington, is secretary.

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$250,000 Bill-of-Health

WITH

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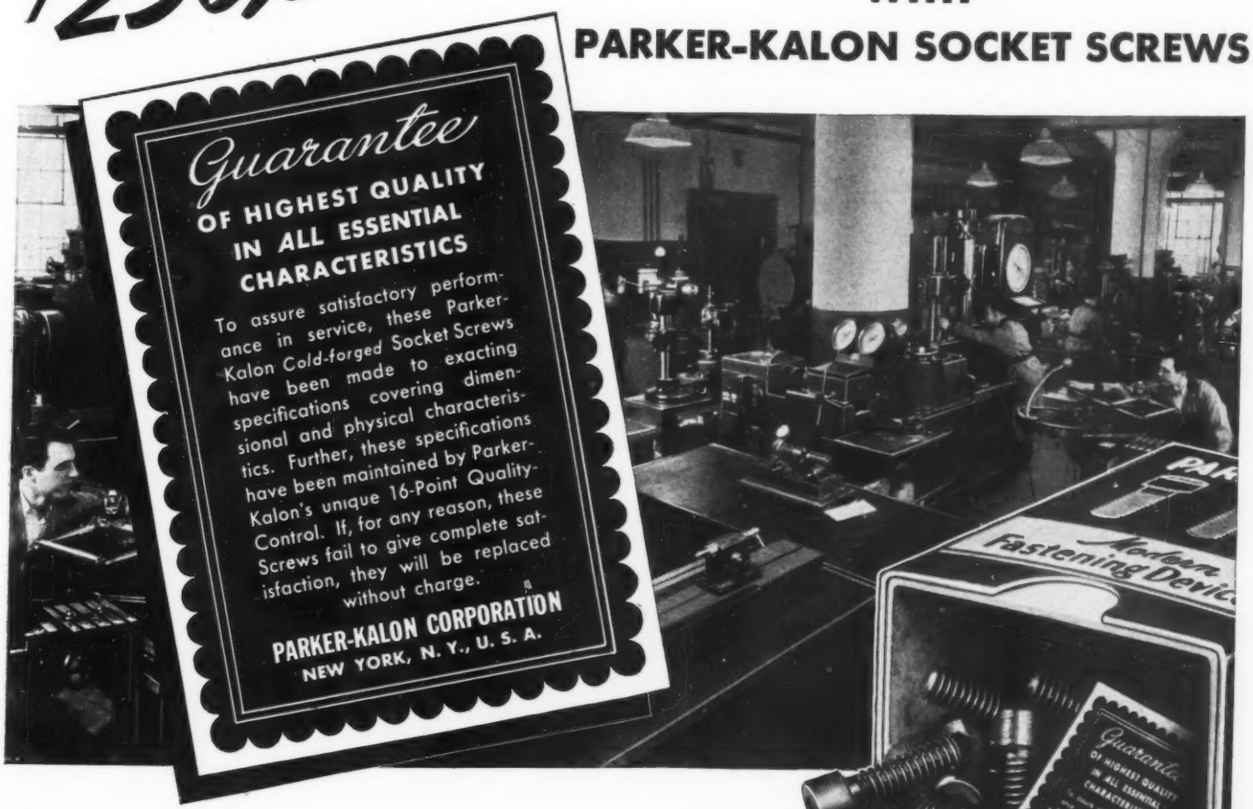
Guarantee
OF HIGHEST QUALITY IN ALL ESSENTIAL CHARACTERISTICS
To assure satisfactory performance in service, these Parker-Kalon Cold-forged Socket Screws have been made to exacting specifications covering dimensional and physical characteristics. Further, these specifications have been maintained by Parker-Kalon's unique 16-Point Quality-Control. If, for any reason, these Screws fail to give complete satisfaction, they will be replaced without charge.
PARKER-KALON CORPORATION
NEW YORK, N. Y., U. S. A.

"16-POINT QUALITY-CONTROL" Makes Possible A Guarantee That "MEANS SOMETHING"

Into every box of Parker-Kalon Cold-forged Socket Screws goes this unusual Guarantee . . . a "clean bill-of-health" for every screw in the box . . . issued by Parker-Kalon's $250,000 Quality-Control Laboratory *only* after 16 rigid tests and inspections covering:

1–Chemical Analysis. 2–Tensile Strength. 3–Ductility. 4–Torsional Strength. 5–Shock Resistance under Tension. 6–Shock Resistance under Shear. 7–Hardness. 8–Head Diameter. 9–Head Height. 10–Concentricity of Head to Body. 11–Socket Shape. 12–Socket Size. 13–Socket Depth. 14–Centricality of Socket. 15–Class 3 Fit Threads. 16–Clean Starting Threads.

In this way, Parker-Kalon maintains a new higher standard of quality in Socket Screws . . . a standard that satisfies the most critical buyer. Send for free samples.

PARKER-KALON CORPORATION, 212 Varick Street, New York, N. Y.

PARKER-KALON Cold-Forged SOCKET SCREWS

HAVE YOU THOUGHT OF CERTIFIED FELT for

• AUTOMOTIVE GREASE SEALS?
Certified Felt has proven itself of great value in automotive grease seals; the grease is effectively sealed in, dust and dirt are excluded; the extremely high temperatures to which grease seals are often subjected are efficiently withstood by Certified Felt.

• OIL SEALS WITH DUFELT*?
Dufelt, a combination of Certified Felt and Dupont Neoprene, has been accepted as an extremely efficient but inexpensive oil and grease sealing medium.

* REG. U. S. PAT. OFF.

• OIL FILTERS?
For filtering purposes, Felters Certified Felt is manufactured in many different consistencies; it is economical and easily installed; the natural filtering tendencies of the high-grade felt make it highly effective.

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Certified Felt, in addition to its normal function of sealing, allows the bearing to "breathe"!

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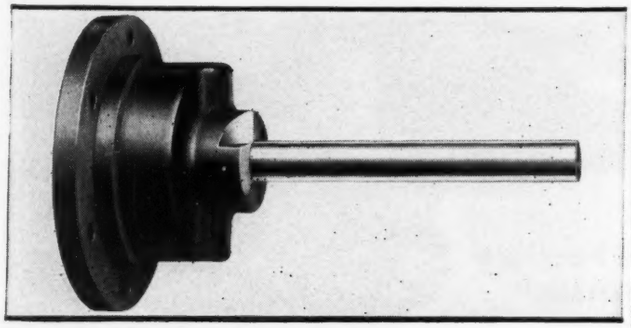

—for Economy . .
in pressure lubrication
- -use Vane Pumps
built into your units.
Special mountings made for your particular needs.
(Special flanged mounting shown)
Write — Brown & Sharpe Mfg. Co.
Providence, R. I.
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BROWN & SHARPE PUMPS
B·S

Business and Sales Briefs

ELECTION of Oscar C. Schmitt as vice president has been announced by The Emerson Electric Mfg. Co. Mr. Schmitt was formerly vice president in charge of sales. Raymond E. Otto, manager of motor sales, has been promoted to manager of sales and William R. Fraser, formerly district manager, New York city, is now manager of motor sales, located in St. Louis.

♦

A new warehouse, located in Los Angeles, is being built by Linde Air Products Co., New York.

♦

Erection of an addition to the plant of Standard Pressed Steel Co., Jenkintown, Pa., is now under way.

♦

Formerly vice president of American Chain & Cable, George C. Moon has been made general manager of sales for the company. He has been identified with the wire rope industry for many years. William D. Kirkpatrick, who has been general manager of sales, American Chain division, has been elected vice president. Mr. Moon's headquarters will be at 230 Park avenue, New York city; and Mr. Kirkpatrick's at York, Pa.

♦

The district office of Allis Chalmers Mfg. Co. at Richmond, Va., of which C. L. Crosby is manager, has been moved to a new location—the Richmond Trust building. The new location of the Rockford, Ill., office is in the Gas-Electric building. John Breutzman is in charge of this district.

♦

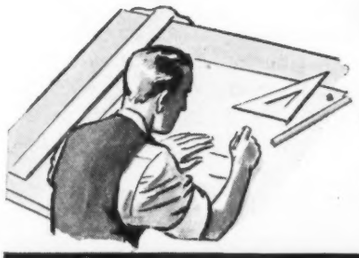
Associated for twenty years in various sales capacities with Timken Roller Bearing Co., Canton, O., W. B. Moore has been appointed director of sales of the Steel and Tube division. Beginning with the company as an engineer after graduation, he had several years of engineering and sales training in the company's office, and later was in charge of the Pacific coast district. He has been manager of industrial sales since 1933. S. C. Partridge, formerly assistant manager of industrial sales, succeeds Mr. Moore as manager.

♦

Well-known throughout the industry for his practical knowledge of steel and tubing problems, as well as research work, C. H. McCollam, metallurgist of the Steel & Tube division of The Timken Roller Bearing Co., has been appointed assistant director of steel sales. Mr. McCollam has been connected with the company more than twenty-one years.

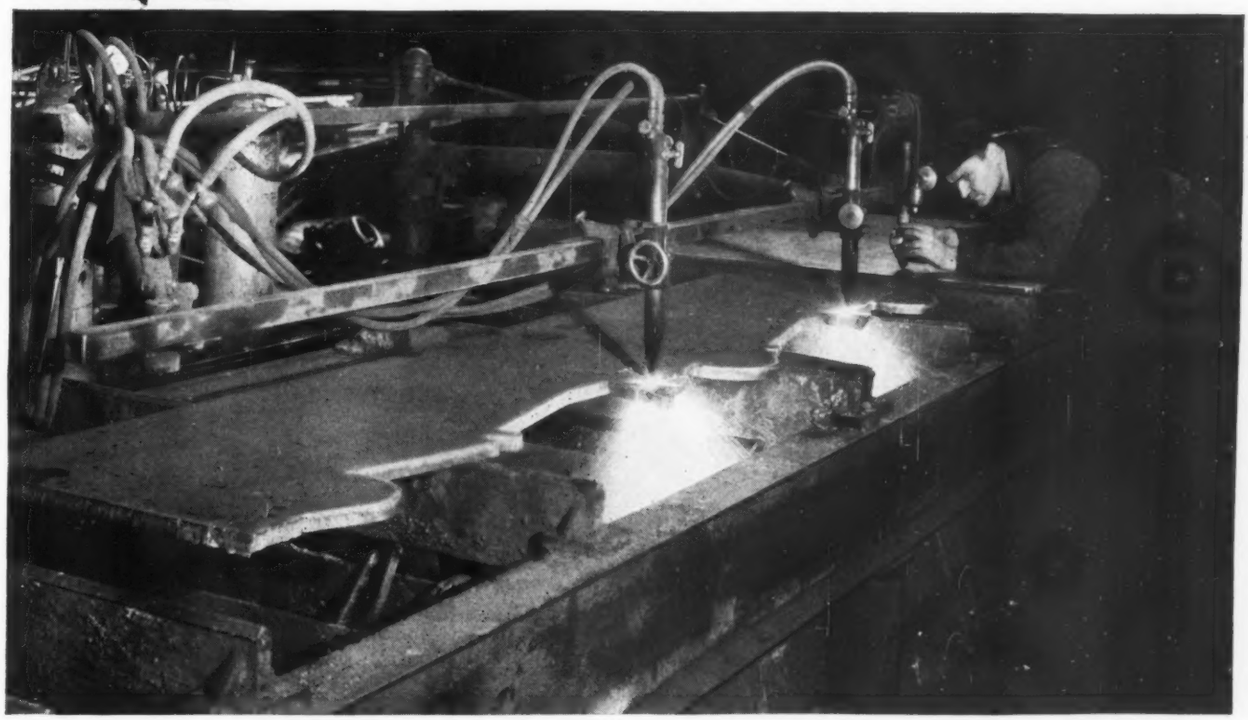
♦

New licensees have been appointed by New Wrinkle Inc., Dayton, O., for the manufacture and sale of its Wrinkle finishes. These are: John H. Witte & Sons, Burlington, Ia.; St. Louis Surface & Paint Co., St.



DESIGN FOR WELDING

. . . and take full advantage of simultaneous multiple cutting



Equipment is a one-piece unit *when assembled by welding*. It weighs less — yet is rugged enough to withstand severe shock and strain. Products designed for welding are also economical — particulariy when constructed with flame-cut parts. Additional economies can often be earned by simultaneous multiple cutting.

Where quantities of parts are required—whether large or small — the Airco line of cutting machines make welded construction more profitable. Here, an Oxygraph illustrates the economies possible by cutting hinges for clam shell buckets, two at a time, in the Wellman Engineering Company's Cleveland Plant. » » » Design your product for welding — remember, Airco can help you get the most out of machine gas cutting and also from welding, both by the oxyacetylene and the electric arc processes. Write for full details.

AIR REDUCTION

SALES COMPANY

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y. DISTRICT OFFICES IN PRINCIPAL CITIES**

AIRCO *Anything and Everything for* GAS WELDING or CUTTING and ARC WELDING WILSON

FORGET PUMP SERVICE WORRIES

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Dependable TUTHILL PUMPS

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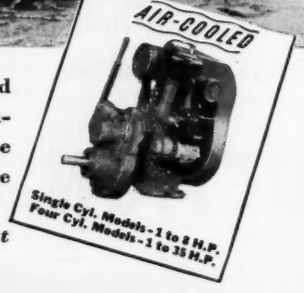
"ONLY *Air-Cooled* POWER WILL DO"



No other type of engine would satisfactorily power this Diamond drill, which must be extremely portable and free from any engine troubles.
Further Details on Request

HEAVY DUTY AIR COOLED ENGINES

WISCONSIN MOTOR CORPORATION
MILWAUKEE • WISCONSIN

Louis; and Standard Paint & Varnish Co., Windsor, Ont., Canada. Further announcements by the company include the extension of Wrinkle finish activities of A. C. Horn Co., Long Island City, to include its plants in Boston, Chicago, Dallas, Houston, San Antonio, New Orleans and San Francisco. Maas & Waldstein Co., Newark, N. J., is extending its Wrinkle finish activities to its other plants located at Chicago and Los Angeles.

♦

David K. Miller, since 1937 district representative at Baltimore for Crucible Steel Co., has been appointed manager of this branch, located at 1007 Court Square building. He has been connected with the Crucible company for thirteen years.

♦

For the past several years sales manager of Precision Bearings Inc., Los Angeles, Harold Swanton has been elected vice president, succeeding Norman Bell, resigned.

♦

Associated with Pittsburgh Screw & Bolt Corp. for more than twenty years, John A. Dillon has resigned as vice president of Eastern sales of the company.

♦

After serving as supervisor of tubing sales for the Hamilton Steel Co., Cleveland, W. R. Wood has been appointed Chicago district sales representative for the Ohio Seamless Tube Co., Shelby, O. W. J. Miller succeeds Mr. Wood with the Hamilton company, distributor for the Ohio Seamless Tube Co.

♦

According to a recent announcement by G. H. Shill, plastics department manager of General Electric Co., Pittsfield, Mass., Arthur R. Tinnerholm has been appointed product engineer of the Ft. Wayne plant of the company's plastics department. Mr. Tinnerholm was connected for six years with Mica Insulator Co., and later was sales manager of the Specialty Insulation Mfg. Co.

♦

Appointment of J. F. Gilmore Co., 810 South Spring street, Los Angeles, has been made by The Kropp Forge Co., Chicago, to handle its line of drop, upset and hammer forgings. The Gilmore company will represent the company in the lower California and Arizona territories.

♦

Territorial representatives have been appointed for the turbine pump division of Roots-Connersville Blower Co., Connersville, Ind., as follows: John A. Dodd, located at 101 Marietta building, Atlanta, Ga., will cover the entire state of Georgia. Smith & Berry, 1316 First avenue, Birmingham, Ala., will be in charge of the state with the exception of Mobile. L. W. Oakley, 408 West Clinch avenue, Knoxville, Tenn., will cover Tennessee with exception of western counties comprising the Memphis area and several counties in western

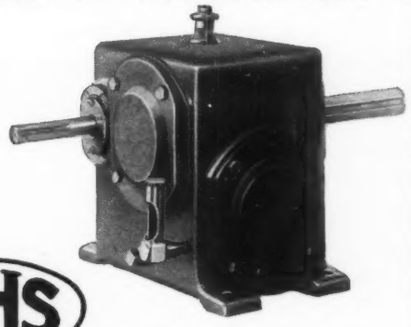
ENGINEERED AND TESTED FOR COMPLETE SATISFACTION

Timken Bearings

•

Bronze Worm Gears

•



WHS

SPEED REDUCER

No. 3DB shown above is a recent addition to our nationally known line which covers the range from 1/4 to 75 H.P. . . . . ratios from 2-1 to 20,000-1. Leaders in the field . . . . economical in first cost and long operation . . . . WHS Speed Reducers are the result of nearly 40 years of specializing in the manufacture of speed reduction units.

Send for Catalog

WINFIELD H. SMITH, Inc.

A Speed Reducer for Every Application

16 ELTON STREET, SPRINGVILLE, ERIE COUNTY, N. Y.

A 21 inch diameter card index wheel weighing 10 lbs. or a ¼ inch diameter adjuster bushing,—smaller than a kernel of corn—and weighing only 1/40 of an ounce are both good Plastic Molded applications.

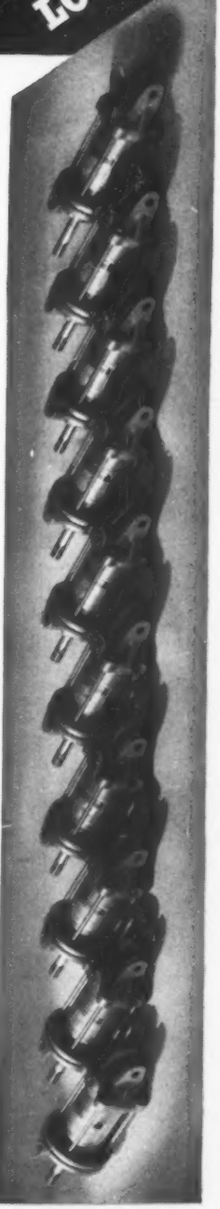
So versatile are plastics that they are adaptable to countless applications which improve a product and lower its production costs.

Our engineering staff will cooperate with you on your plastic molding problems.

CHICAGO MOLDED PRODUCTS CORP.

1028 NO. KOLMAR AVE. CHICAGO, ILLINOIS

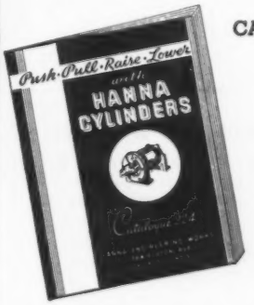
MORE *Hanna Cylinders* ON THEIR WAY TO PUSH PULL RAISE LOWER



Low first cost of these Cylinders has enabled users to effect satisfactory savings.

Prompt deliveries eliminate the necessity of your stocking cylinder units in anticipation of requirements.

Available in several models in sizes from 1½" diameter up, for both Hydraulic and Pneumatic Systems. Length of stroke to suit. Let us send catalogue containing illustrations, dimensions, etc.



CATALOGUE 228

Hanna Engineering Works

1772 ELSTON AVENUE

CHICAGO, ILL.

North Carolina. Leo L. Roussel, 2733 Dumaine street, New Orleans, La., will represent the company in the lower half of Louisiana and Mississippi. The entire state of Nebraska and western counties of Iowa will be covered by B. G. Peterson, 6235 Florence boulevard, Omaha, Nebr. George A. McLaughlin, 741 Stanton avenue, Springfield, O., will represent the company in the counties comprising that area. Covering the state of North Carolina, excepting the extreme western counties, will be W. B. Simons, 2324 Briarwood road, Charlotte, N. C. Empire Gas & Equipment Co., 722 Twelfth street, Denver, Colo., will cover the state of Colorado and southeastern Wyoming.

•

Heretofore vice president in charge of casting sales for Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., R. A. Cannon has been appointed vice president in charge of sales for the company.

•

George S. Case, general manager of the Birmingham, Ala., plant of Lamson & Sessions Co., Cleveland, has been elected to the board of directors, replacing the late Chester C. Bolton.

•

A recent announcement has been made by Tinnerman Stove & Range Co., Cleveland, stating that the company will completely discontinue manufacturing stoves and ranges, due to the rapid growth of the speed nut division of the company. In view of this development the company has announced the formation of Tinnerman Products Inc. Accordingly all facilities will be devoted to the manufacture of speed nuts and speed clips.

•

George A. Blackmore, president of Westinghouse Air Brake Co., and Arthur W. Page, vice president and director of American Telephone & Telegraph Co. of New York, have been elected directors of Westinghouse Electric & Mfg. Co.

•

Square D Co., specializing in motor control and switch equipment, has acquired the Kollsman Instrument Co., manufacturer of equipment for the aviation industry. It is planned to include Mr. Kollsman's ideas and apparatus in general industry as well as aviation.

•

L. M. Perkins, who has an intimate knowledge of the air conditioning field, having been connected with Carrier Corp., will be in charge of development and sales promotion as manager of the air conditioning and refrigeration control division of Allen-Bradley Co., Milwaukee.

•

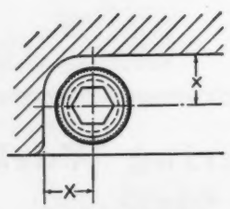
Allegheny Ludlum Steel Corp. has recently announced that new buildings will be erected immediately on River road, Buffalo, N. Y., to house new equipment to supplement the only electric steel melting furnace reported to be the only one of its type in the country devoted exclusively to making stainless steel castings.

DRESS UP YOUR PRODUCT WITH

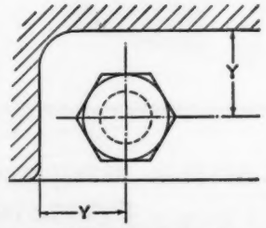
KNURLED UNBRAKO SOCKET HEAD CAP SCREWS

And Achieve More Compact Designs

These plan views clearly show how close to the corner the "Unbrako" can be placed compared with the placement of ordinary screws which require setting back to allow for hex head and wrench.



See how the Knurled "Unbrako" snuggles right into the corner.



Notice the great open spaces necessary for the hex head and wrench.

These cap screws with their distinctive "Unbrako" heads—knurled for better grip—enhance the appearance of any piece of equipment on which they are used . . . a fact verified by designers and engineers who are specifying "Unbrako" for equipment in many industrial lines.

In addition to neatness, "Unbrako" permits reduced flange sizes as illustrated at left, saves material, weight and cost.

Write for Literature and Samples.

Fig. 1434 Pats. Pend. With the "Better Gripping Head"

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS

JENKINTOWN, PENNA.

BOX 102

BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

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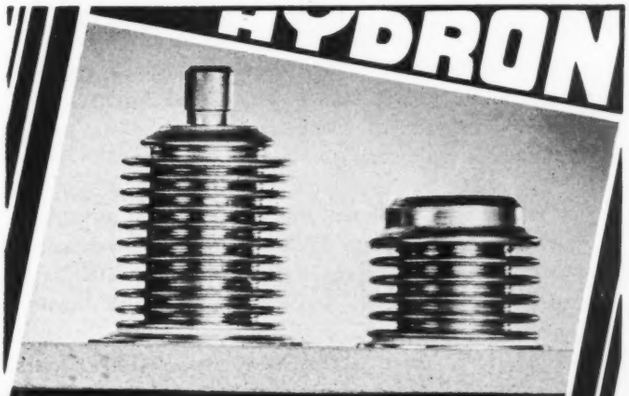

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and OTHER MECHANISMS
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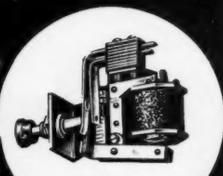
Control



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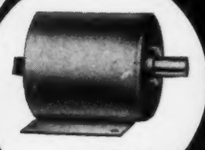

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MEN OF MACHINES

(*Concluded from Page* 58)

year was appointed chief designer for the aviation section of the Signal Corps, later returning to the Martin company. Coming to California in 1920, Mr. Douglas with David R. Davis formed the Davis-Douglas Co. and designed the "Cloudster" which was a step toward a Navy contract for several airplanes. In four years under his direction, the Douglas company produced a new design, the "DWC" for the U. S. Army, and later the DC-1 and DC-2 models.

Mr. Douglas is an honorary fellow and past president of the Institute of Aeronautical Sciences. He received the Collier Trophy for 1935 in recognition of his development of twin-engined commercial transport airplanes.

♦

HARRY GLAENZER, who has veen vice president in charge of engineering of Baldwin Locomotive Works for the past eighteen years, has resigned because of ill health. He has been connected with the engineering department for forty-one years.

♦

J. WHEATLEY, who for the preceding two years has been in charge of aerodynamics and flight test engineering at the El Segundo division of Douglas Aircraft Co., has been appointed chief research engineer of Glenn L. Martin Co.

♦

PHILIP TORCHIO, retired vice president of Consolidated Edison Co. of New York Inc., was recently awarded the 1939 Edison medal of the American Institute of Electrical Engineers—the highest award in electrical engineering.

♦

DONALD C. BAKEWELL has been elected president, Steel Founders' Society of America, Cleveland, at the recent meeting of the society's new board. Mr. Bakewell is vice president, Union Steel Castings division, Blaw-Knox Co., Pittsburgh. ARTHUR K. READING, vice president, Zimmerman Steel Co., Bettendorf, Ia., was elected vice president.

♦

DR. OLIVER E. BUCKLEY, executive vice president of Bell Telephone Laboratories, New York, has been elected chairman of the Engineering Foundation, succeeding the late PROF. GEORGE E. BEGGS.

♦

PROF. HERBERT C. SADLER has resigned after thirty-nine years as a member of the faculty of University of Michigan College of Engineering. The titles of dean emeritus of the College of Engineering, and professor emeritus of naval architecture and marine engineering have been conferred upon him.

♦

I. C. MOREAU has been made assistant to L. S. WOOD, vice president in charge of engineering of Gar Wood Industries Inc., Detroit.

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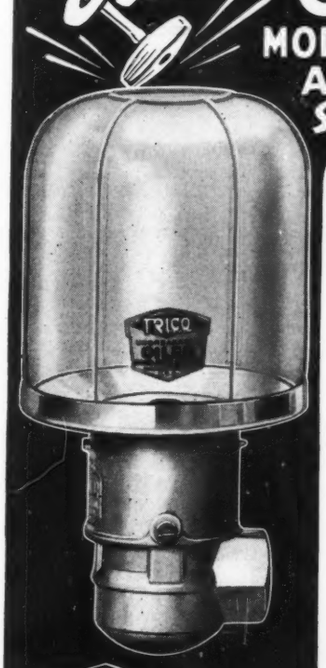

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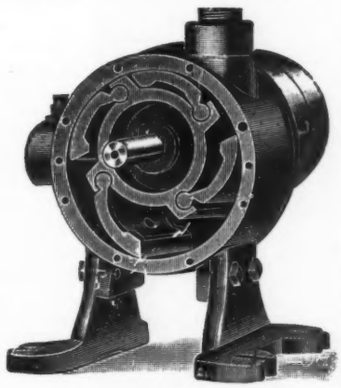

And every machine, like every man, is benefited by having a good heart—one that responds when called upon for its best efforts, not one that quits when it is most needed. And in this instance it costs no more when you get a machine with this good heart—the most powerful and long-lasting air pump made.

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Bottling machinery

Calculating & counting machines
Cameras (including motion picture) & projectors
Canning machinery
Card-punching, sorting & tabulating machines
Cars & trucks, industrial & mining
Cash registers
Cement & concrete machinery
Centrifuges—separators
Change-making machines, taxi meters and ticket-counting machines
Check-writing machines
Chemical machinery
Clay-working machinery, brick, pottery, etc.
Clocks, time recorders & watches
Clothes-pressing machines
Coffee-roasting & grinding machines
Coin-operated machines
Condensers, other than electrical
Confectionery & ice-cream machinery
Conveying machinery including elevators and escalators
Cotton ginning machinery
Cranes, including hoists & derricks
Crushing, grinding & pulverizing machinery

Dairy, cheese factory & butter factory machinery
Dental machinery
Diesel engines
Dish-washing machinery
Dredging & excavating machinery including power shovels
Duplicating machines

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Electric & pneumatic portable tools
Electric razors and hair clippers
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Engines, steam & internal combustion

Fare registers & boxes
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Flour-mill & grain-mill machinery
Foundry machinery

Gas machines
Gas regulators
Glass-making machinery
Grinding, buffing & polishing mchy.

Hat-making machinery
Hydraulic equipment, incl. pumps

Incandescent lamp-making machinery
Industrial ovens & electric furnaces
Inspection machinery

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Labelling machinery
Laundry and dry cleaning machinery

Lawn mowers
Leather-working machinery not including shoe machinery
Locomotives, rail cars, etc.
Lubricating machines

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Metalworking machinery
Meters, gas & water
Mining machinery, not incl. oil drilling
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Motor vehicles, except motorcycles
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Well-drilling machinery
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NEW MACHINES—
And the Companies Behind Them

(For illustrations of other outstanding machinery see Pages 54-55)

Air Conditioning

Compressors, Quincy Compressor Co., Quincy, Ill.

Baking

Eighty-quart dough mixer, Read Machinery Co. Inc., York, Pa.
Revolving tray type oven, Cincinnati Oven Co., Batavia, O.
Vibrating sifter, Read Machinery Co. Inc., York, Pa.

Bottling

Labeler, Pneumatic Scale Corp. Ltd., Quincy, Mass.
Two-tube air cleaner, U. S. Bottlers Machinery Co., Chicago.
Semiautomatic labeler, Economic Machinery Co., Worcester, Mass.
Automatic Kottoner, Consolidated Packaging Machinery Co., Buffalo.
Single head capper, Pneumatic Scale Corp. Ltd., Quincy, Mass.

Business

Electric adding-figuring machine, Underwood Elliott Fisher Co., New York.
Automatic typewriter, American Automatic Typewriter Co., Chicago.
All metal scale, Triner Sales Co., Chicago.

Ceramics

Spray machine of turntable type, Binks Mfg. Co., Chicago.
Rotary tablet presses, Kux-Lohner Machine Co., Chicago.
Vibratory feeder, Syntron Co., Homer City, Pa.
Pulverizers, Pulverizing Machinery Co., Roselle Park, N. J.

Dairy

Irradiator, National Carbon Co. Inc., New York.
Rotary can washer, and soaker type bottle washer, R. G. Wright Co. Inc., Buffalo.
Cellophane hooding machine, Package Machinery Co., Springfield, Mass.
Dispenser machine, SlectoR Products Co., New York.
Filler and capper, Fort Wayne Dairy Equipment Co., Ft. Wayne, Ind.

Domestic

Terrazo radios, Pascal Sylvester Co., Chicago.
Refrigerator, Ace Products Co., Cincinnati.
Electric washer, 1900 Corp., St. Joseph, Mich.
Combination phonograph, radio and television set, Andrea Radio Corp., Woodside, L. I., N. Y.
Celeste, Gretsch & Brenner Inc., New York.
Oil burner, Herco Oil Burner Corp., Lancaster, Pa.
Electric ranges and refrigerators, General Electric Co., Schenectady, N. Y.
Ironer, Armstrong Products Corp., Huntington, W. Va.
Plastic radio, Sentinel Radio Corp., Evanston, Ill.
Victrola and radio, RCA Mfg. Co., Camden, N. J.

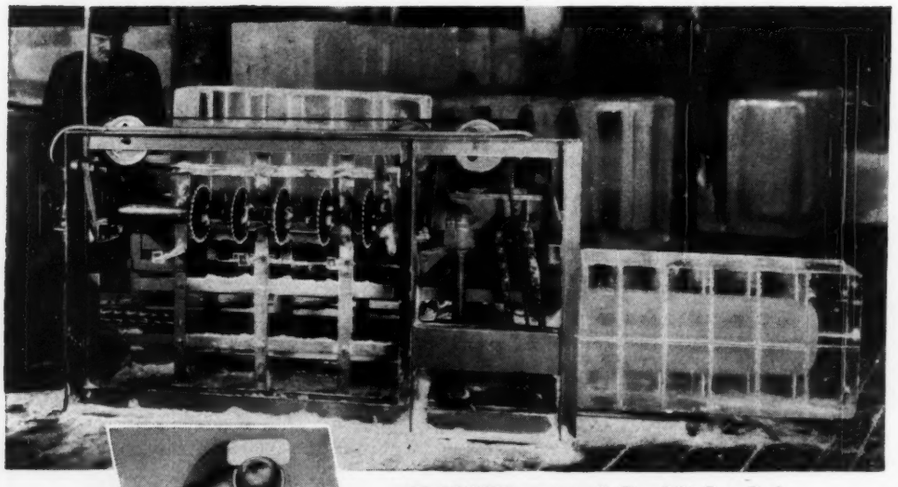
Food

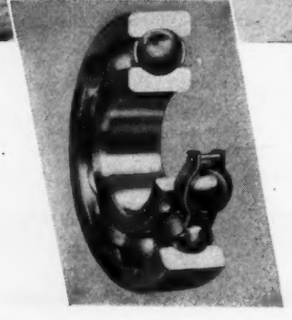
Batch peanut roaster, Jabez Burns & Sons Inc., New York.
Coffee infuser, L. O. Koven & Bro. Inc., and Greenhead Tablepad Co., Jersey City, N. J.
Granular material blender, Blaw Knox Co., Pittsburgh.
Small air powered mixer, Eclipse Air Brush Co., Newark, N. J.
Mixing unit, Mixing Equipment Co. Inc., Rochester, N. Y.
Laboratory size dryer, Louisville Drying Machinery Co., Louisville, Ky.
Triplex dry blender, Patterson Foundry & Machine Co., East Liverpool, O.
Fruit syrup mixer, L. O. Koven & Bro. Inc., Jersey City, N. J.
Rotary blancher, Chisholm-Ryder Co. Inc., Niagara Falls, N. Y.
Syrup and jelly mixer, Abbe Engineering Co., New York.

Metalworking

Tool and cutter grinder, Oliver Instrument Co., Adrian, Mich.
Hydraulic flanging press, Watson-Stillman Co., Roselle, N. J.
Portable electric nibbler, Independent Pneumatic Tool Co. Chicago.
Grinder, Baldor Electric Co., St. Louis.
Saddle type turret lathe, Warner & Swasey Co., Cleveland.

BCAs run COOL as the ice this GIFFORD-WOOD machine cuts





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Once set up, these screws automatically lock into place and will not shake free under the severest vibration. They're easy to turn into place, too . . . the ingenious knurling that insures locking protection offers no resistance during the operation. And removal or adjustment can be made at any time with the ordinary hex bar wrench. Also, "Unbrakos" can be used over and over again with the same effectiveness.

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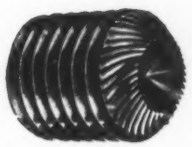

Fig. 1645 Pat's. Pend.

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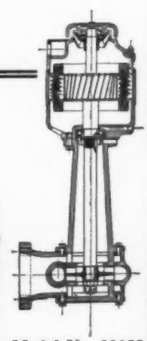

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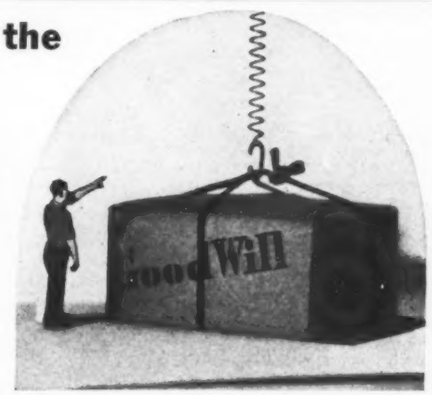

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